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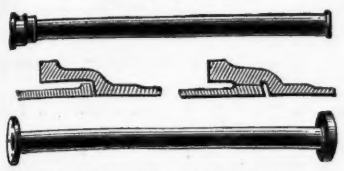

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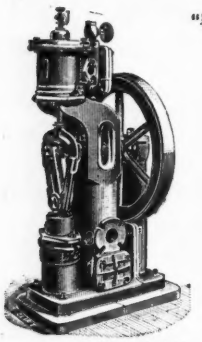

Fig. 703. "SINGLE RAM" STEAM-PUMP.

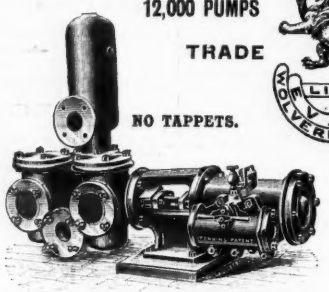

Fig. 568. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

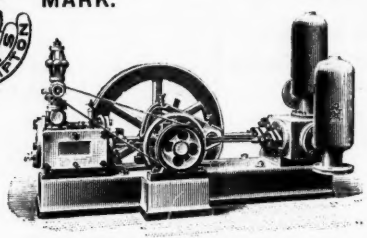

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

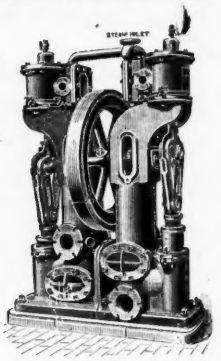

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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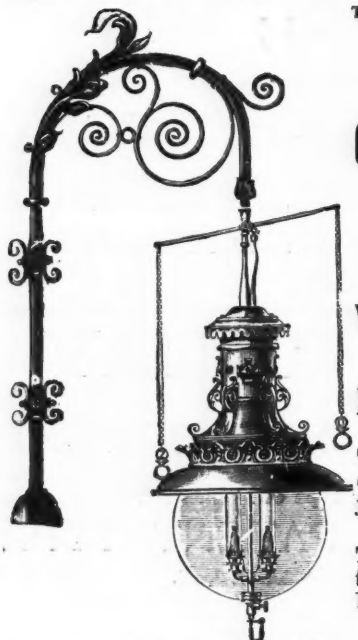

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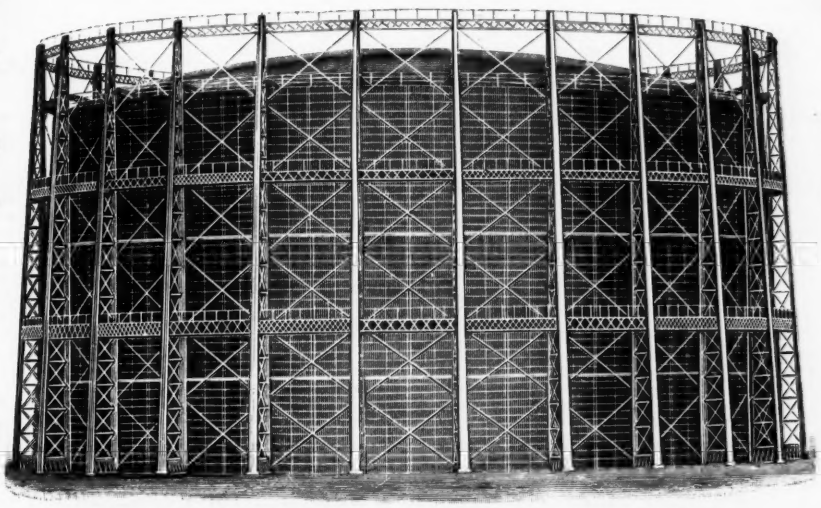

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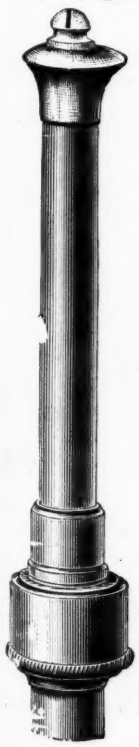

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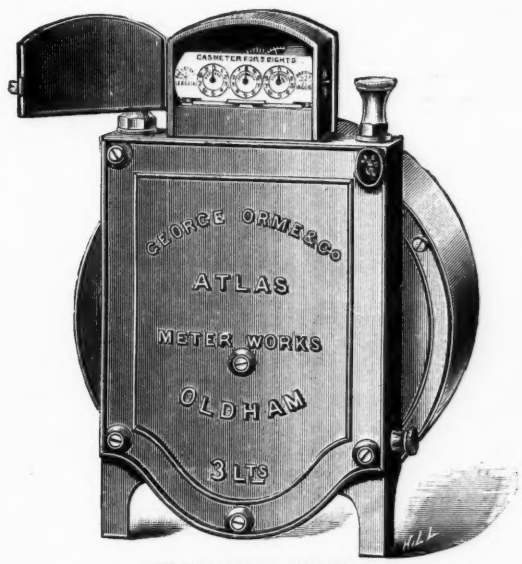

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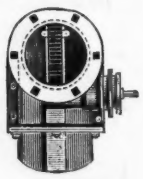

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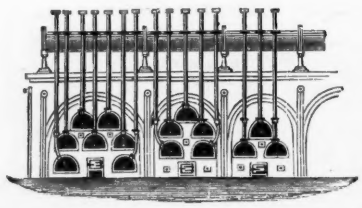

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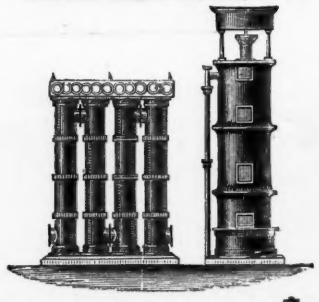

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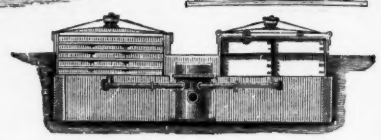

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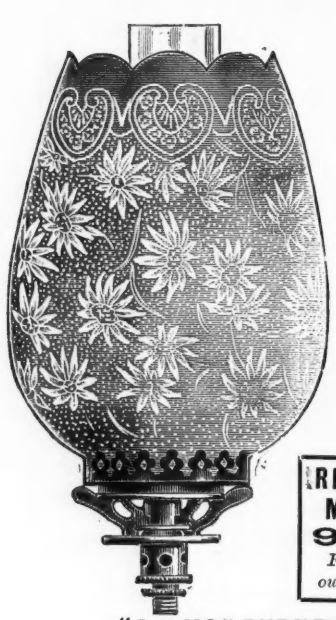

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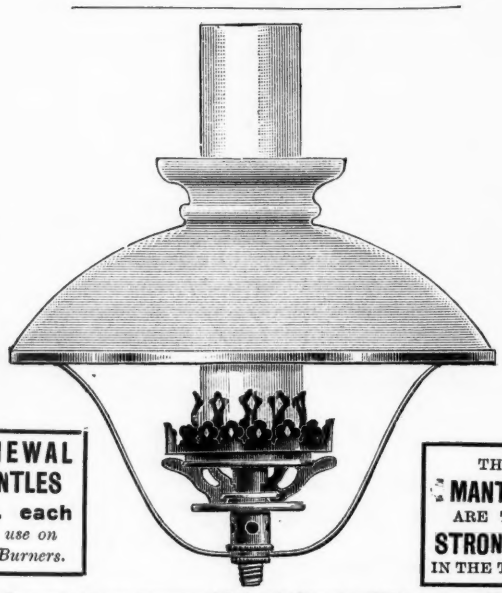

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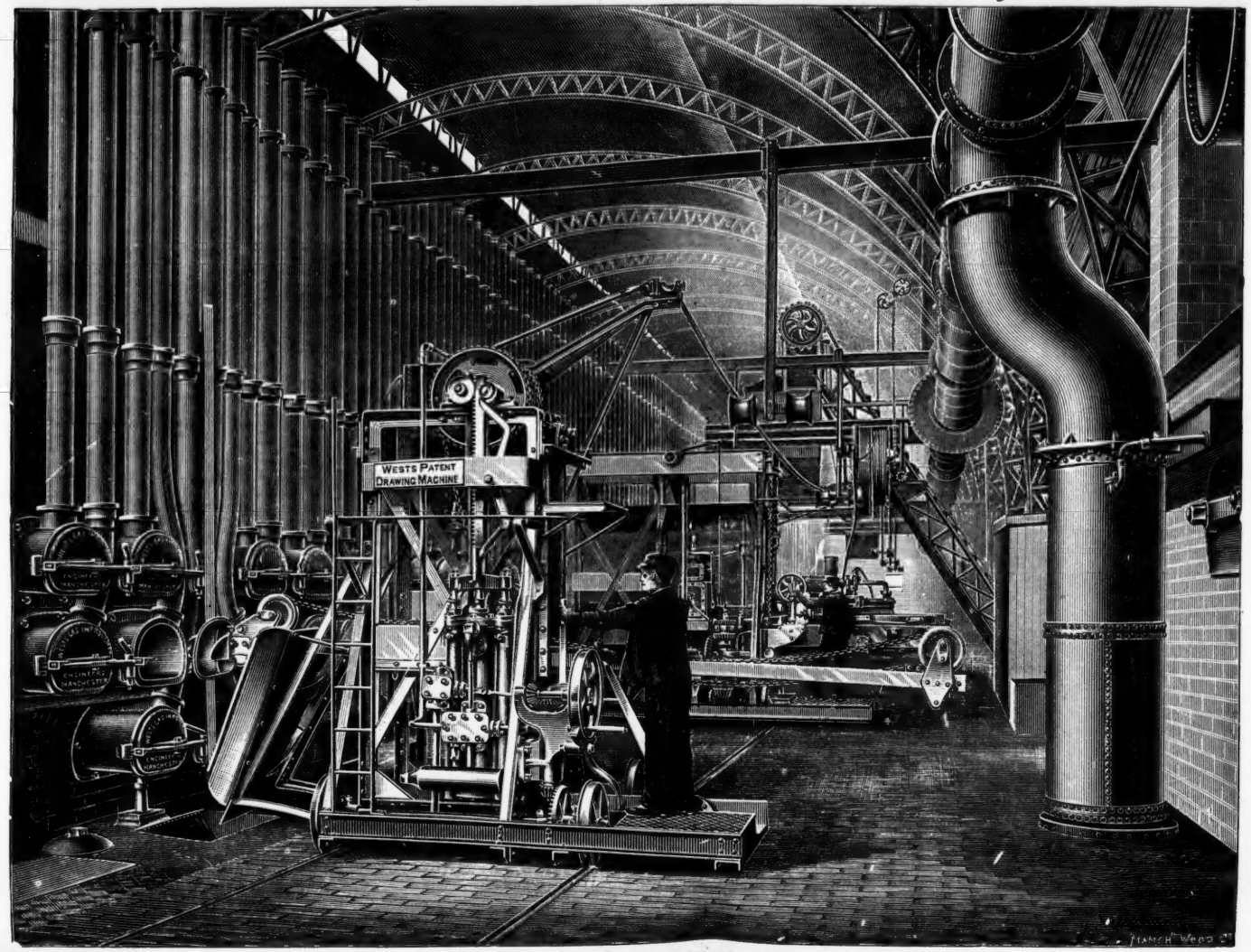

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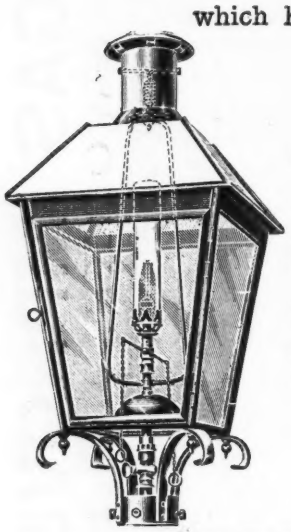

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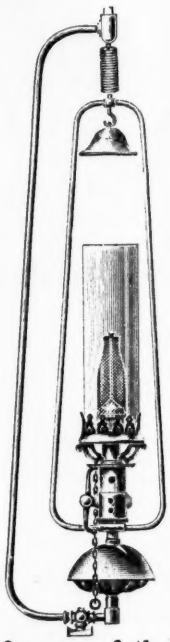

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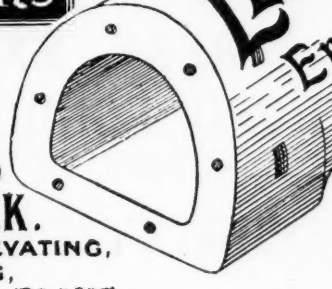

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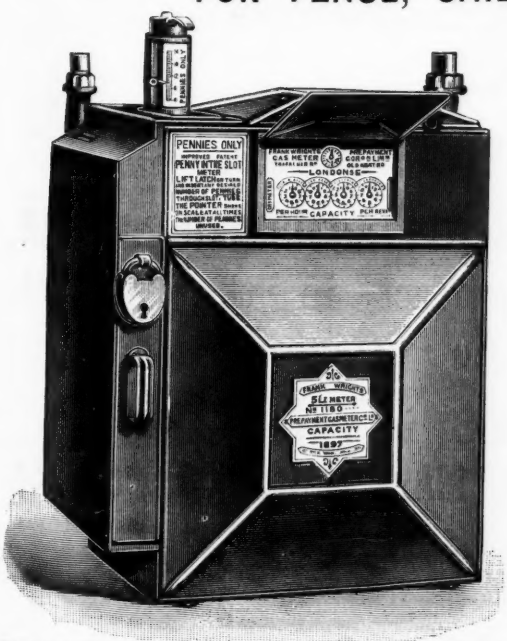

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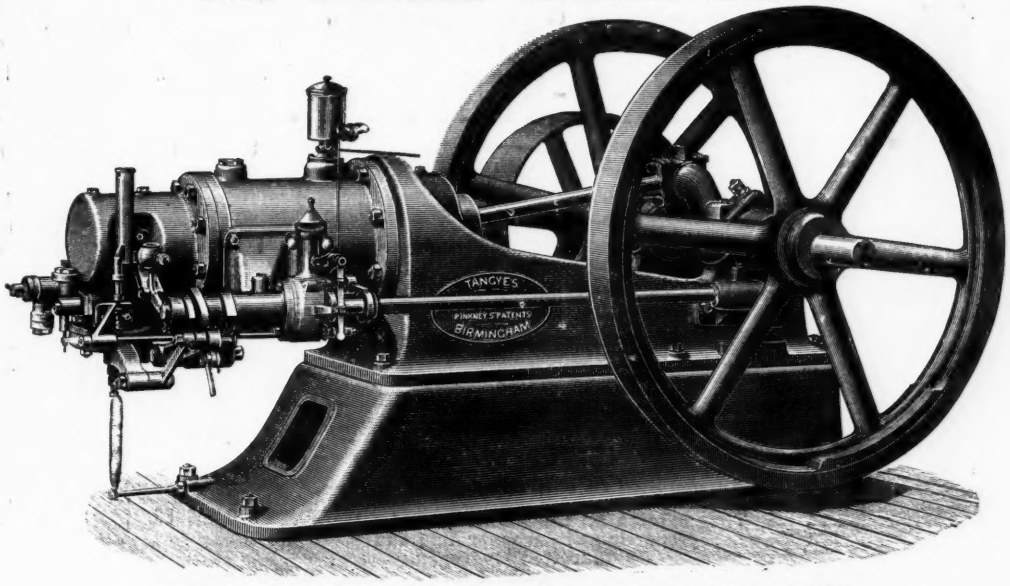

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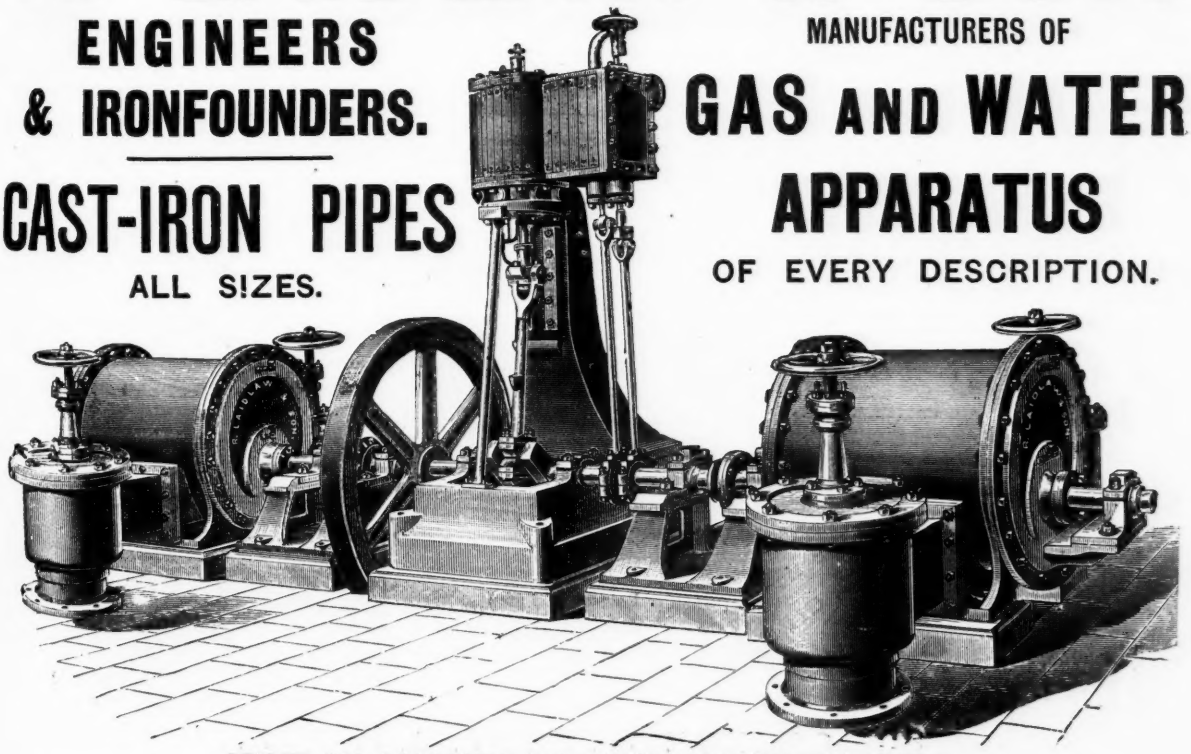

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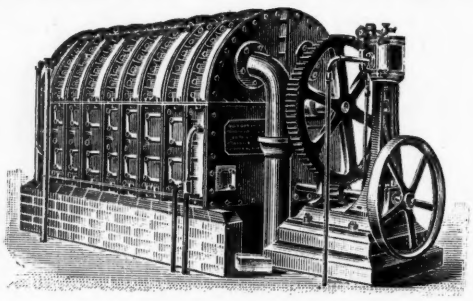

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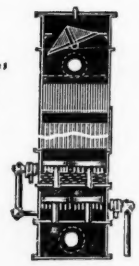

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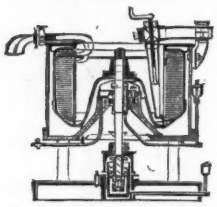

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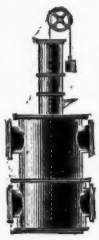

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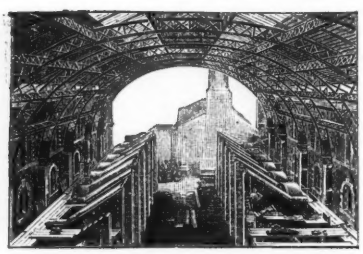

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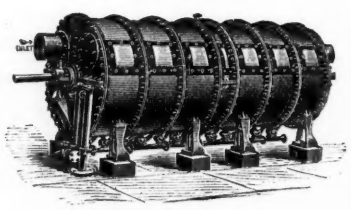

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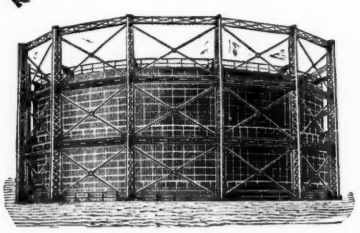

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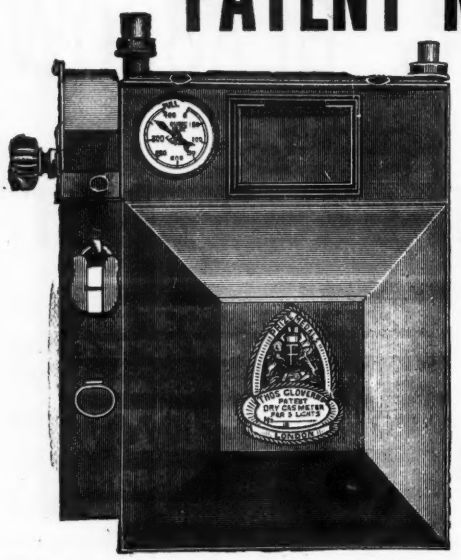

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TO CORRESPONDENTS.

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EDITORIAL NOTES.

The London Gas Companies' Accounts for 1896.

UPON another page will be found our annual abstract of the accounts of the London Gas Companies. In regard to the capital of the Companies, it is to be pointed out that the stock conversion of the South Metropolitan has had the effect of rendering it impossible to make any comparisons between many of the figures of this year's tables and those of former years, and also between the statistics of the different Companies which relate to capital. Hence criticism of the data is made difficult, and must be restricted to those of revenue and working. It appears that last year London paid for gas supplied for private consumption the huge sum of £3,793,422, besides £234,089 for public lighting. Both these sources of income exhibit a substantial increase, which was shared by all the undertakings in their degree. The private consumers paid £156,659 more for gas than in 1895, and this notwithstanding the vastly increased economy in the use of the illuminant rendered possible by the modern improvements in gas burners, stoves, and engines. Residuals returned £1,042,006, which was a falling off of £136,536, or nearly equal to the increase upon gas; and inasmuch as this diminution of revenue was absolute loss, whereas the larger gas-rental was not all gain, the balance went heavily against the undertakings. Matters would have been much worse if there had not been some economies on the expenditure side. Even as it was, the Companies paid £43,152 more in transacting their extended business. The table of data reduced to the engineering basis of the ton of coal carbonized is, of course, the most instructive; though even here the disturbing element of oil and petroleum spirit enters to destroy the uniformity of the statistics. One of the most striking entries in this table is the close approximation to one level of the cost of carbonizing material to the different Companies, which has never before been so nearly realized. Once more, the works expenses of the Companies varied considerably. For the reasons already mentioned, we are constrained to leave these tables to the consideration of our readers, instead of discussing the totals and ratios at length, as was our custom when the figures were more strictly comparable. The same must be said with regard to the small table of carbonizing results which follows, and which also exhibits an unprecedented degree of uniformity of results. The mean results shown in the table do not call for comment.

TABLE *showing the Residuals produced per Ton of Coal and Cannel, and the Gas made per Ton of Coal, Cannel, and Oil, by the Metropolitan Gas Companies in the Year* 1896.

Name of Company.	Coke.	Breeze.	Tar.	Am. Liq.	Gas.
	Cwt.	Bushels.	Gallons.	Gallons.	Cub. Ft.
CHARTERED	12·37	3·33	10·32	29·56	10,223
COMMERCIAL	12·03	3·25	9·87	38·20	10,003
SOUTH METROPOLITAN .	12·28	4·45	9·94	33·95	10,220
Mean per Ton . .	12·33	3·63	10·18	31·40	10,206

The Judgment in the South Metropolitan Rating Appeal.

JUDGMENT was given last week in the South Metropolitan rating appeal, in the terms which will be found in another column. The Court has found the net rateable value of the service mains—which was the point at issue between the Company and the various parishes concerned in the appeal—to be £140,272. The Company's figure was about £80,000, as against the Local Authorities' £173,000. The result means a rating of nearly 16 per cent. on the rental earned by the mains. Altogether, the Company will have to pay considerably more in rates than they have done hitherto; but how the various Unions will fare from the judgment cannot appear until the accountants have settled the apportionment. The costs also will follow this event, according to the precedent of Sir Peter Edlin's judgment in the historical Gaslight and Coke Company's appeal at the previous quinquennium. It is hopeless to discuss these rating appeals with a view to extracting any intelligible principle from the methods of valuation involved. The whole system of assessment is discreditable to the commercial reputation of the nation. One would think it should be possible to discover some means of ascertaining the figure

at which gas undertakings ought to be rated, without having recourse to this cumbrous and expensive procedure, which throws an extremely onerous burden upon Quarter Sessions, and does no good to anybody but a small army of surveyors who constitute a conspicuous class of non-producers. It might be argued that the principles upon which gas-works are valued for assessment are clear enough, and are deducible from the general law for the valuation of hereditaments for the same object. All the same, there is far too much scope for conflicting interpretation of these principles; and this is the source of all the waste and annoyance of the existing practice.

Scottish Gas Managers' Meetings.

Scottish gas managers met in considerable numbers last week in Glasgow and at Haddington. The former gathering was the so-called "Informal" meeting of gas managers of the West of Scotland, of which Mr. James M'Gilchrist has had charge, in the capacity of Convener, since its institution as an annual function. Mr. M'Gilchrist has now, to the general regret, resigned this honourable and honorary position, and is succeeded by Mr. A. Yuill, of Alloa. Last Wednesday's meeting was presided over by Mr. W. Smith, of Ayr, who invited the company to talk over the question of unaccounted-for gas. This systematized talking of "shop" is the end and aim of the meetings, which are much more successful now than they were when the same men were subject to the formalities and regimen of a regular technical association, with its papers, and votes, and subscriptions. A greater piece of informality than usual marked Wednesday's proceedings, inasmuch as the meeting was made the opportunity for the presentation to Mr. R. S. Carlow, the Secretary of the North British Association of Gas Managers, of a more than handsome testimonial subscribed for by the members and friends of this Association, in acknowledgment of his ten years' service as Secretary and Treasurer. Mr. Carlow is to be congratulated upon his happy fortune in having his merits so recognized by his professional associates; and the pleasing irregularity of the choice of an occasion for the function was perhaps intended to signify that the gas managers of all Scotland are as one. At Haddington, the Waverley Association met for the seventy-second time, under the presidency of Mr. W. Blair, who is succeeded in the chair by Mr. H. Rutherford, of Aberlady. The faithfulness of the gas managers of the Scottish border counties to their harmonious and unpretentious little Association is one of the most pleasing things in the history of technical societies.

Continuation of the Samson Fox Libel Suit.

Through all last week the Samson Fox libel suit dragged its weary length before the patient Baron Pollock and the Middlesex special jury sitting in Queen's Bench Court No. 2. After the plaintiff had passed through his ordeal of cross-examination by Sir Frank Lockwood, a series of financial and commercial witnesses led up to the scientific element, represented upon this side by Sir Henry Roscoe, Professor V. B. Lewes, and Sir Douglas Fox. Then came more accountants and business men; and it was not until Friday that the end of the plaintiff's case hove in sight. The Court did not sit on Saturday, but met again yesterday. It was arranged, to suit the general convenience, after the close of the plaintiff's case yesterday, that the matter should stand adjourned over the Easter Vacation, until the 29th inst. In this way what would otherwise have been an awkward break in the defendants' case is avoided. At this stage of the proceedings, it is only necessary to warn our readers that we cannot pretend to give anything like a complete report of the many observations and statements necessarily made in the conduct of a trial of which the subject-matter occupies a geographical distribution from the State of Pennsylvania in the West to Witkowitz in the East, and from Glasgow in the North to Gresham Street in the City of London. At the same time, we are doing our best to preserve a record of all the really important technical portion of the proceedings, not forgetting a glance at the finance. The current reports of the trial in the Daily Press, with the exceptions of "The Times" and some of the principal Lancashire, Yorkshire, and Scotch newspapers, are contemptible in quality, and inadequate in length. Nobody could possibly form from them an approximately correct notion of how the trial is going on, or how it is likely to end.

Royal Assent to the Workman-Director Bill.

The South Metropolitan Gas Bill, having passed through all its stages as an unopposed measure, received the Royal Assent on Thursday, and is therefore law. Whatever one may think of the merits of this scheme of legislation, it must be conceded to mark an epoch in gas and industrial legislation which cannot be permitted to escape the notice of the faithful chronicler. It presents for the first time to the industrial world a suggestion and a procedure aiming at the breaking down of the barrier between master and servant, between employer and employed, which all modern financial and industrial legislation hitherto has accentuated, and even tended to magnify. Such projects of law as the Employers' Liability Bill, for instance, are based upon the assumption that, for the objects which they have in view, employers and employed constitute two opposed, if not necessarily antagonistic, forces in the community. Such an Act as the one now under notice belongs to a totally diverse order, and brings into prominence a radically different assumption. It assumes, in short, that, for certain purposes and under definite conditions, employed can become employers. It is not to be wondered at that many well-intentioned people have experienced great difficulty in reconciling themselves to this proposition. We do not intend at present to say a word about any future action under the new law in order to carry it into effect. It is to be taken for granted that no undue delay will be shown in this regard; but it is also certain that each step will be very carefully pondered, and made with every respect for whatever may be respectable in the tradition which the Act so potently infringes. For the time being, it is enough to congratulate Mr. George Livesey and his colleagues of the South Metropolitan Board upon the triumph they have won. Their opponents as well as their supporters must join at least in acknowledging the intrepidity and steadfastness that have carried them so far; and we, for our part, have no reluctance in wishing them well through the rest of it.

English Patents and Foreign Monopolists.

It was not to be supposed that the commercial and industrial interests of the country would rest satisfied with the perfunctory reply of the President of the Board of Trade to Captain Phillpotts with regard to the position of foreign patentees under the British patent law. On Thursday last, the matter was again brought before the Board of Trade officials by a deputation, mainly from Manchester, who had an interview with Sir Courtenay Boyle, in the enforced absence of Mr. Ritchie. Sir W. Houldsworth introduced the deputation, and said that its object was to urge upon the Board of Trade the expediency of amending the Patents Act of 1883, especially in regard to the operation of the 22nd section, which has so far been a dead letter. Here, as stated in the House of Commons by Mr. Ritchie, the advocates of reform are met at once by the official intimation that the Department has never been asked to put the section in force. This is an official view, all over: "You ask to have a section of the Patents Act "amended. How do we know it is ineffective, seeing that "nobody has ever tried what can be done with it?" Sir W. Houldsworth and other members of the deputation did their best to expose the shortcomings of the section that has never been tried; and Sir Bernhard Samuelson offered the interesting autobiographical statement that he was himself partly responsible for the drafting of the section complained of. At the time this was done, he had in mind mainly the question of master-patents; as, when a patent had been taken out for an invention, and an improvement was subsequently made, the improver was absolutely barred unless he could make an arrangement with the previous patentee. The important question that has since arisen in regard to the monopoly of foreign patentees, did not suggest itself at this period. In replying to the deputation, Sir Courtenay Boyle pointed out that denunciation of a provision of law without proof of its inadequacy or wrongfulness, is not a practical road to reform. He was not willing to admit that the Act of 1883 had failed to subserve the ends desired by the deputation, for the simple reason that, as already remarked, it had never been tried. He suggested that carefully selected test cases should be prepared for submission to the Department, in order that it might be seen whether or not the Act is workable as it stands. This is a right and proper course, to be followed with respect to the alleged inadequacy

of section 22; but there is a growing sense of dissatisfaction with the bearings of the English patent law upon the case of foreign patentees, which is not limited to any such grievances as the section might be found to cover. There are, for example, the interests of the national trade and of the public welfare, which are involved in the exploitation of the country by foreign monopolists. This is a matter which may not concern any individual in such a way as to lead to the taking of action under section 22 of the Act. The question is, does the public advantage really require that patents which hold good in the United Kingdom should be exploited here, according to the parallel examples of France and Germany? So far as we are aware, this economical question has never been properly worked out by any independent and competent authority. Yet it is the general problem of which the case laid by the deputation before the Board of Trade is only a specific development. Patents, it is but too often forgotten by specialists, are intended to serve the general interest of the community, through the particular interest of the patentee. Which is the preferable way of securing this benefit to the fullest possible extent, the English or the French? Everything depends upon the answer to this query; yet it has never been answered, to our knowledge. Will a professor of Political Economy kindly oblige?

The Infringement of Patents by Importation.

A very curious and remarkable lawsuit, growing out of much the same order of circumstances that form the subject of the preceding paragraph, has just been settled for the time being by a judgment of the Court of Appeal. It was an action brought by the Badische Anilin und Soda Fabrik against Henry Johnson and Co. and the Basle Chemical Works, Bindschedler. Both the plaintiffs and one of the defendants are foreigners; and the subject of dispute touches the conflicting interests of patentees, alleged infringers, and retailers of patented commodities. It is a commonplace of British trade that the owners of British patents are greatly plagued by manufacturers carrying on business in foreign countries, such as Switzerland and Holland, where there is no patent law, who send into this country articles made purposely to infringe the British patents. What with the foreign pirate manufacturers at one end, the home retailer at the other, and the parcel post as the connecting link, the British patentee is in the position of seeing his market spoilt without having much chance of redressing the wrong. For if he catches the retailer and makes the latter submit to an injunction, he is powerless against the piratical manufacturer, who is the greater offender, and is continually opening up trade in a fresh place. In the case in point, an English firm of drysalters purchased of a Swiss house a parcel of coal-tar dyes for which the Badische firm hold the English patent. Upon information of this transaction reaching the Badische firm, they took proceedings against Messrs. Johnson and Co., who submitted to judgment, and also against the Swiss firm, in which they were equally successful. The latter were not within the jurisdiction, but they confessed such jurisdiction by appearing to the writ in the English Court, so as to have the question settled. The parcel of infringing dye was actually delivered by the Swiss firm to a local forwarding agent, who sent it to London by post; the charges for this service being collected on delivery. In allowing the appeal, Lord Justice Lindley seemed to regard the intervention of the forwarding agent as material; but Lord Justice A. L. Smith dismissed the point as immaterial. Both Lords Justices, however, agreed that, in acting as exporters from Switzerland for conveyance to England of a commodity which was admittedly an infringement of an English patent, the Swiss firm could not be regarded as offending against English law. It was the English purchasers who were the importers, and they undoubtedly broke the law. Lord Justice Rigby differed from the majority of the Court; holding that the Swiss firm, by setting the post in motion, performed the act which made them infringers of the patent that was in force in the place of destination of the parcel. There is a good deal to be said on both sides of the question; and as there is every probability of the matter being carried to the House of Lords, it is impossible to say how the law will eventually be defined. The question is of enormous importance to all patentees of, and dealers in, articles that can be forwarded by post, which nowadays constitute a very numerous class.

WATER AND SANITARY AFFAIRS.

The opposition of Mr. Stuart to the Bill of the East London Water Company came to rather a sudden end last week. The objection on behalf of the London County Council simply had reference to the fifth clause, the purport of which was probably misunderstood. To remove any suspicion which may have been excited, the Company consented to withdraw the clause in question and substitute another, by which it would be made clear that they sought for no extended powers, but simply to utilize those they already possessed. A statement of the arrangement thus arrived at was made to the House of Commons by Colonel Lockwood last Thursday; and Mr. Stuart expressed himself satisfied. He had on the paper a notice of motion to appoint a Select Committee to deal with all the Bills promoted by the London Water Companies during the present session; but he did not propose to take any further action in regard to the East London Company. There appears a courteous tone in Mr. Stuart's acceptance of the Company's proposal; and we should like to think that in future a more reasonable spirit will guide the policy of the County Council on the Water Question than has been observable in the past. At the meeting of the Council to-day, a report is to be presented from the Parliamentary Committee, stating that by clause 5 it was proposed to appropriate the water of the River Lea. The Committee simply say that the clause is "struck out" by the Company's Agent. The Bill is said to be "thus "confined to powers for making new reservoirs for the "storage and treatment of the water which the Company "now have power to take." We apprehend that this was all the Company proposed in the first instance, only there may be two ways of saying one thing. Colonel Lockwood has expressed a hope that Mr. Stuart and the County Council are at last convinced of the *bona fides* of the East London Company, and will henceforth assist the Company instead of opposing them. Yet the case seems a little like that of the man "convinced against his will." A satisfactory incident in Parliament last week, for which no thanks are due to the County Council, consists in the decision of the Standing Orders Committee of the Lords, following that of the Commons, by which the Southwark and Vauxhall Bill will be allowed to proceed. The Bill will therefore be considered on its merits by a Select Committee. Respecting the Royal Commission on the Metropolitan Water Supply, an attempt by Mr. Sydney Buxton to introduce some conditions with respect to the purchasing part of the inquiry, has been met by Mr. Chaplin with an intimation that the Commissioners must be left to adopt such methods as they may deem desirable. Whether it be an arbitration or an inquiry, there is the same attempt from the Progressive party to interpose conditions which shall govern the decision. But the Commissioners in this case are to be left to the unfettered exercise of their own judgment.

Incorporated Institution of Gas Engineers.—We learn from the Secretary of the Institution (Mr. Thomas Cole) that at the forthcoming meeting, to be held at the Institution of Civil Engineers on the 5th and 6th prox., under the presidency of Mr. Corbet Woodall, M.Inst.C.E., about half-a-dozen papers in all will be read and discussed. The annual dinner will take place at the Trocadero Restaurant on the evening of the first day. Friday, the 7th, will be devoted to a trip down the river, with visits to the Rotherhithe station of the South Metropolitan Gas Company and other works.

Eastern Counties Gas Managers' Association.—We learn from the Hon. Secretary of the Association (Mr. J. H. Troughton, of Newmarket) that the seventeenth general meeting will be held in the Board-room at the Peterborough Gas-Works on the 21st inst. The members will assemble at the Grand Hotel shortly after noon for light luncheon, and will proceed at 1.45 to the works. The retiring President (Mr. A. Drage) will conduct the first portion of the business proceedings, which will comprise the election of two new members; and he will then introduce his successor, Mr. J. T. Jolliffe, of Ipswich. Apart from the Inaugural Address, there will doubtless be an instructive discussion on the paper read by Mr. R. G. Shadbolt at the last meeting, on "The Self-Enrichment of Coal Gas," which will be supplemented by some further particulars from the author. Peterborough was chosen by the members as the most suitable town in which to hold the spring meeting; and the Committee are desirous of having as good an attendance as possible. At the close of the business, the members and friends will, as customary, dine together.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 850.)

LAST week found a better feeling generally prevailing in the Stock Markets. Although business continued within very moderate proportions, yet there was a good steady tendency, and quiet buying of choice stocks went on; for it was felt that, if only a conflagration in the East could be prevented, the public could not much longer hold aloof. When on Thursday the Bank Directors lowered the rate from 3 per cent. (fixed on Feb. 4) to 2½ per cent., it was taken as evidence that the outlook was considered favourable in well-informed quarters. But the news on Saturday of an actual outbreak came as a rude shock; and much of the improvement in prices made during the week was spoilt. Nevertheless a balance in favour is left in all the markets except Americans and mines. The settlement went quite smoothly. But the next account is a long one; and it commences under disquieting circumstances. Business in Gas was about up to the average point of activity. Movements were somewhat irregular. The hostility to the leading stock continued; and sales were rather pressed. But taking all the list, there is very decided preponderance in favour of higher values. After losing a couple of points, Gaslight "A" steadied itself; and the final mark of 303 on Saturday was as good as the average opening prices on Monday. Money awaiting investment was attracted to the secured issues, among which the "K" 6 per cents. had a further advance. South Metropolitan was unable to rally, and, after hanging fire all the week at 142, finally dropped a point. Scarcely anything was done in Commercials for want of stock to deal in. Both issues were quoted at a rise *ex div.* Business in the Suburban and Provincial division was of the quietest. Croydons advanced; and Alliance, after being put down a point on Thursday, was promptly reinstated. In Continentals, Imperial was less excited; and, after some little dealing, it even managed to pick up a point, and its 4 per cent. debenture did the same. Union and European were unaltered. Among the rest, the only change was an advance in Cape Town. In the Water Companies' stocks, there was a little quiet business, with no particular feature of any interest. East London was quoted lower *ex div.*; but its 4½ per cent. debenture stock advanced.

The daily operations were: Business was pretty active in Gas on Monday. But it was mostly confined to Gaslight "A"; and prices were not varied. In Water, East London 4½ per cent. debenture rose 2. Tuesday's transactions showed no falling off in volume; but Gaslight "A" receded 2. Imperial Continental 4 per cent. debenture rose 1. There was a considerable lull in activity on Wednesday; and prices underwent no change. Attention was revived on Thursday; and a fair amount of stock changed hands at the old figures. Alliance fell 1. Friday was fairly active; and there were some symptoms of a tendency towards more firmness. Alliances were the better; both Commercials rose 2½; Gaslight "K," 2; and Imperial, 1. South Metropolitan fell 1. East London Water receded 1½. Saturday was very quiet; but movements were favourable. Both Croydons rose 2; and Cape Town, ½.

PROFESSOR SEXTON ON FUEL.*

WHEN an author, and especially one who is also a "professor" of the subject of which he writes, tells the world that his book is "intended to meet a want," he employs a familiar—indeed, an almost inevitable phrase. It is, moreover, a locution which has been so terribly abused, that its repetition challenges criticism on the point of justification. Hence we approach this particular work, not only without any prepossession in its favour, but rather with a heightened sense of the duty that rests upon a reviewer of technical literature of determining for his public whether the subject of his notice is worthy of a place among the select company of indispensable aids to study, or is merely one more of the far more numerous examples of book-making that the world can very well do without. Speaking generally, it is surprising to hear that there was any noticeable lack of books about fuel, and that the subject has been very much neglected, before Professor Sexton took it up. Still, one lives and learns, and it may well be that in his teaching at Glasgow Professor Sexton felt the need of a smaller, cheaper manual devoted to the subject of fuel, and couched in the way in which he has been accustomed to treat of it in his own lectures. It is gratifying to be able to state that the work of reducing Professor Sexton's lecture notes to writing, so as to make such a manual, has been well and instructively done. The first chapter deals with combustion, which is described and explained with great clearness, and without a superfluous word. The author soon gets upon terms with his readers, who will not fail to appreciate his simple, and hence truly scientific, language. He is not of those who think it sounds more scientific to speak of a "circular orifice" than of a round hole.

The author gives both the Davy and Frankland hypotheses of the luminosity of flame; but he makes a slight slip in stating that the Welsbach mantle owes its illuminating power to the use of zirconia. He inclines to Lewes's view that the luminosity of flame depends "not so much on the actual amount of carbon contained in the gas, or on the temperature, as on the readiness with which the gases present form acetylene or some other hydrocarbon which will similarly dissociate." The observations of Lewes on the cause of the non-luminosity of the bunsen flame are also accepted. The work of Deville upon the propagation of flame through combustible gaseous mixtures is mentioned; but the researches of Dixon on waves of explosion are omitted. An ordinary domestic fire is taken as an example of smoky combustion. Speaking of heating by gas, the author very properly lays stress upon the facts that flame cannot touch the comparatively cold surface of a boiler-plate, and that the non-luminous flame is a bad radiator. The ordinary British system of units is employed throughout the book, which is a recommendation in the estimation of the practical man, who abhors the metric system. For those who are accustomed to think in grammes, degrees centigrade, and calories, the results of calculations by this system are also given in italic figures.

The author adopts the definition of coal given by Dr. Percy: "Coal is a solid stratified mineral substance, black or brown in colour, and of such a nature that it can be economically burnt in furnaces or grates." He repeats Professor Thorpe's remark that cannel coal always occurs in basin-shaped patches, thinning away to nothing on all sides; and he thinks it originated in vegetable matter drifted down from streams into ponds or lakes. In describing the geographical distribution of coals, the author gives diagrams showing the comparative areas of the coal deposits of various countries. It is rather surprising to see the small area of the anthracite coal region of the United States contrasted with the enormous bituminous coal-field. This appears to indicate that the future will be more with coal gas than with carburetted water gas in this part of the world. The classification of bituminous coals is into caking and non-caking, between which it is observed there is every gradation. It is admitted that the cause of caking, or coking, as it might have been expressed, has not yet been thoroughly made out. The manufacture of coke is explained and well illustrated. The author says all that need be told upon this head. He is prudently chary of expressing a preference for any particular pattern of improved retort-ovens—"recovery-ovens," he calls them; but he evidently thinks that the prejudice of ironmasters against coke made in this way must disappear. He is not quite justified in saying that coke is unsuitable for boilers and similar furnaces. Naturally, he is strongly in favour of coal washing.

Gas-producers are well and exhaustively treated; but, singularly enough, the reasons for the employment of gaseous fuel for specific uses are not explained or discussed. Professor Sexton has not been sufficiently careful to confine his selected examples of gas-producers to actually working and successful models. He has overlooked in this place, moreover, the interesting late Siemens modification, which consist in returning some of the spent products of combustion to the furnace. He mentions the Mond producer, and recognizes the advantages possessed by producers of the blast-furnace type. Little is said about oil gas; but this is hardly to be classified as a fuel. In naming the advantages of gaseous fuel, Professor Sexton enumerates them as follows: "(1) The supply of both air and gas is under control, so that any required temperature can be maintained with perfect regularity for any time; and also the nature of the flame can be regulated so that it can be made oxidizing, reducing, or neutral, as required. (2) Perfect combustion can be maintained with a very slight excess of air over that theoretically required, and no smoke need be produced. (3) Much higher temperature can be attained than is possible with solid fuel, as both air and gases can be heated to a high temperature by means of regenerators before combustion. (4) Changes of temperature being less, the furnaces, &c., will last longer. (5) A commoner quality of fuel can be used. (6) The great ease with which the gas can be conveyed in pipes to any part of the works required; all the solid fuel being delivered at the producers placed conveniently for the purpose. (7) The gas can be used directly for the production of energy in a gas engine." It is odd that with all this the author should have omitted to explain why it is that for certain purposes—not all—producer gas is to be preferred to solid fuel. He does not say in so many words that the former is cheaper, in some circumstances, notwithstanding the loss of heat by conversion, which is the first thing an engineer would think of.

Professor Sexton thinks that the question whether it is advisable to wash producer gas for the recovery of the bye-products is not definitely settled; but one would think that this is precisely what Mond has settled. There is certainly no ground for the statement that "the washed gas, being freed from dense hydrocarbons, burns with a less luminous flame;" for a few lines further on there occurs a table of analyses of washed and unwashed blast-furnace gases which proves that the gas contained nothing heavier than marsh gas, which is quite unaffected by washing. Professor Sexton appears to temporarily forget that coal gas is abundantly washed, and is not hurt by the operation. The author is very good upon furnaces for metal-

* "Fuel and Refractory Materials." By A. Humboldt Sexton, F.I.C., F.C.S., Professor of Metallurgy in the Glasgow and West of Scotland Technical College; President of the West of Scotland Iron and Steel Institute, &c. London: Blackie and Son, Limited; 1897.

lurgical purposes; yet here again he is too hospitable to designs which are mere notions put forward under high-sounding appellatives by individuals who have no working results to show. The chapter on "Pyrometry" is well written; but the matter which supplies the author with the second part of his title—refractory materials—occupies only a small space at the end of the book. What there is is of high quality, and freshly written.

Altogether, we can allow, without reserve, that Professor Sexton has justified his action in regard to writing this book, which is well adapted to the needs of students, while older technicians may consult it with advantage. The matter is always well presented to the reader; and the illustrations are not unworthy of the text.

PERSONAL.

Dr. Frederic Hetley, one of the Directors of the Crystal Palace District Gas Company, has been appointed a Deputy-Lieutenant of the County of London.

By a regrettable oversight, Mr. R. Rist was stated last week to have been elected a Director of the Brentford Gas Company, instead of the Brentwood (Essex) Gas Company.

Mr. J. S. Lucking, of Solihull, is the successor of Mr. J. A. Fielding as Manager of the Rhos Gas-Works, and not Mr. H. Fielding, as stated in the "Journal" for the 30th ult.

At a largely attended meeting of the employees at the Swan Village Gas-Works of the Birmingham Corporation, held last Thursday in the Masonic Rooms, West Bromwich, Mr. E. A. Harman, who for the past six years has held the office of Resident Engineer and Superintendent at the works, was presented with a travelling-bag and a dressing-case, on leaving to take the position of Gas Engineer to the Huddersfield Corporation. Mrs. Harman was also the recipient of a handsome present. Both gifts were suitably acknowledged.

Mr. W. Watts, F.G.S., the Manager of the Oldham Water-Works, who is relinquishing his position, after 25 years' service, to take a similar one under the Sheffield Corporation, as already mentioned in the "Journal," has been presented by the workmen with a fruit and flower stand, as a token of their respect for him. It was accompanied by their best wishes for himself and his family. Mr. Watts, in acknowledging the gift, expressed the hope that his successor would be shown by those under him the same kindness he himself had received from them.

At the last monthly ballot for membership of the Institution of Civil Engineers, Mr. Henry Morley, Engineer and Manager of the Cardiff Gas Company, was elected a member. On the same occasion, the following gentlemen were admitted as associate members: Mr. Clement F. Davis, B.A., of the Sheffield Gas-Works; Mr. Walter J. Hunter, of the Grand Junction Water-Works; Mr. J. W. M. Richardson, of the Birkenhead Corporation Water Department; Mr. A. E. Walker, of the East Surrey Water Company; and Mr. Henry A. Willey, of Exeter.

Mr. Henry Wilde, of Alderley Edge, the President of the Manchester Literary and Philosophical Society, has presented to the French Academy of Sciences the sum of £5500 to be invested in French Rentes. The interest, amounting to about 4000 frs., is to be awarded annually as a prize to the author of a discovery or a work on astronomy, physics, chemistry, mineralogy, geology, or mechanics which may be regarded by the Académie as the most deserving. Mr. Wilde makes this donation in recognition of the advantages he has derived from French science. The prize will be an international one; and it may be retrospective. The letter announcing the gift was written by Mr. Wilde in French, and addressed to M. Berthelot, who read it at the meeting of the Academy on Monday last week. The gift has given great satisfaction. Mr. Wilde has been a diligent student of science; and he is reputed to be the inventor of the dynamo. He is by no means a stranger to the subjects in which readers of the "Journal" are interested; for a quarter of a century ago he investigated the question of the influence of gas and water pipes in determining the direction of a lightning discharge, and embodied the results in a paper he read before the Society of which he is now President. This paper appeared in our columns at the time.

OBITUARY.

Frank Mead.

We regret to record the death, on Sunday, the 11th inst., at the age of forty-five, after only a few days' illness, of Mr. Frank Mead, younger son of Mr. C. R. Mead, of Sutton, Surrey. The deceased was the Engineer and Secretary of the Sutton Gas Company, of which his father is the Chairman. His connection with the undertaking commenced about twenty-eight years ago, when he became Secretary to the lessees of the works; and bringing business abilities of a high order to bear upon the affairs of the concern, he soon placed it in a good position. When the present Company was formed, in 1873, Mr. Mead was elected to fill the two positions he held at the time of his death. Under his supervision, the career of the Company has been a prosperous one. While the quantity of gas manufactured has augmented during the past sixteen years considerably more than 100 per cent., the capital has not been increased by more than about 30 per cent.; and shareholders and consumers alike have benefited by the excellence of the management. Mr. Mead's energies were not, however, confined to the Sutton Company. He was Secretary of the Newhaven Gas Company, Engineer of the Reigate Gas Company, and of the Leatherhead Gas and Water Company, Chairman of the Colombo Gas and Water Company, a Director of the Hong Kong and China Gas Company, of the Bournemouth Gas and Water Company, and of the Sutton Public Hall Company. As an associate member of the Institution of Civil Engineers, and a member of the Institution of Gas Engineers, he kept himself in touch with both general and special engineering questions. He was one of the original members, and was for years one of the most active supporters of the Sutton Scientific and Literary Society; and in various ways he made friends for himself, not only in Sutton, but in many other places. Locally, he will perhaps be best known as an enthusiastic musician. He was specially skilful as a performer on the organ, and was Honorary Organist of Christ Church, Sutton. He also found time to devote to photography, chemistry, and general science. The readiness with which he placed his services, his influence, and his means at the disposal of those who were engaged in any good work, gained for him very general respect. He was a man whose friendship was sought, and valued when obtained. It was his boast that when once a man obtained employment at the Sutton Gas-Works he never wanted to leave it—a statement which is supported by the fact that most of the employees have been in the service of the Company for many years. When a few years ago there was talk of gas strikes all over the country, he was asked how his workpeople stood; and his reply was that a more loyal set of men it would be impossible to find. The Company had never had any trouble with them; and he was confident that, whatever action might be taken elsewhere, the men employed at the Sutton works would not seek to embarass the Directors, either by striking or threatening to strike. This confidence was reciprocated by them; and when his death became known, there was not one who did not express the opinion that he had lost a good friend. The utmost sympathy is felt in Sutton, for Mr. Mead's parents, and also for his widow, to whom he was only married last year, in their great bereavement. The funeral took place last Saturday afternoon, at the cemetery.

The death is announced of Mr. Thomas Varlow, of Brigg, at the age of 71. Deceased took a leading part in local affairs; and for many years he was on the directorate of the Brigg Gas Company, of which he was Chairman at the time of his death.

The death took place at his residence, Park Terrace, Glasgow, last Thursday, of Mr. Alexander Ross, who for about twenty years filled the position of Treasurer to the Corporation Gas Trust. Mr. Ross was invited to accept the gas treasurership when the Corporation municipalized the gas undertaking; and he continued in office until the end of 1889. Just as the department was about to remove into the new Municipal Chambers, Mr. Ross resigned. He was by profession a Writer to the Signet; and he was known during his official career as a man of most independent spirit, and it was the result of a difference of opinion with the Council on a matter pertaining to his office that he relinquished it. He was 67 years of age.

Calcium Carbide from Calcium Tartrate.—A description of an entirely novel method of preparing calcium carbide has been given in the "Chemiker Zeitung." The crude calcium tartrate which forms the settlings from wine-casks is heated to about 930° Fahr. in a cast-iron retort on a galley furnace. A dry, hard, grey, spongy mass, effervescing freely on contact with water, is thus obtained. Water to which the mass has been added froths, and evolves a gas which burns with a brilliant light. This gas is said by S. Zinno, who discovered the action, to be acetylene.

A Gas Loan for the Vienna Municipality.—"Der Gastechniker" states, on the authority of the London correspondent of a Vienna daily paper, that attempts to raise a loan of 60 million crowns (about £2,500,000), for the construction of the municipal gas-works in Vienna, met with an unfavourable reception in Belgium. Inquiries were instituted in certain English financial circles; but they failed to rouse any interest in such a comparatively unimportant business of a purely local character. On all hands, the question was asked why the means for this communal undertaking were not forthcoming in Vienna.

Pentane from American Petroleum.—At a recent meeting of the Chemical Society, under the presidency of Mr. A. G. Vernon Harcourt, a paper on "Some Hydrocarbons from American Petroleum: Normal and Iso-Pentane," by Dr. S. Young and Mr. G. L. Thomas, was read. By fractional distillation of pentane from American petroleum, the authors obtained pure normal and iso-pentane; the boiling points under normal pressure being 36·3° C. and 27·95° C. respectively. On the same occasion, Dr. Young read a paper on "The Vapour Pressures, Specific Volumes, and Critical Constants of Normal Pentane, with a note on the Critical Point." The critical data of normal pentane are 197·2°, 25,100 mm., and 4·303 c.c. The thermal and other data obtained lead to the conclusion that in the liquid state and at the critical temperature the molecules of pentane are simple ones, as in the gaseous state.

ACCOUNTS OF THE METROPOLITAN GAS COMPANIES FOR THE YEAR 1896.

—	Chartered.	Commercial.	South Metropolitan.	All the Companies.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Capital and borrowed money	12,924,950 0 0	908,445 5 11	6,596,629 0 0‡	20,430,024 5 11
Income—viz.:				
Sale of gas by meter	2,676,744 11 9	255,617 6 2	861,060 9 0	3,793,422 6 11
Public lighting, including lighting under contracts	152,105 15 3	19,225 15 4	62,757 9 3	234,088 19 10
Rental of meters and stoves	24,049 2 3*	8,369 8 4	51,507 5 3	83,925 15 10
Residual products	679,389 16 4	73,815 1 3	288,801 18 5	1,042,006 16 0
Miscellaneous, including old materials	12,963 12 0	1,196 13 1	6,094 19 11	20,255 5 0
Total income from all sources	3,545,252 17 7	358,224 4 2	1,270,222 1 10	5,173,699 3 7
Expenditure—viz.:				
Coal and oil, including carriage and dues	1,152,668 14 2	133,967 10 7	438,299 5 2	1,724,935 9 11
Purifying materials, including labour	68,235 12 6	8,303 1 5	22,448 0 10	98,986 14 9
Salaries and wages—manufacture	384,282 9 5	44,263 6 6	114,498 11 2	543,044 7 1
Wear and tear—manufacture	306,629 2 4	33,651 9 3	132,784 16 8	473,065 8 3
Rents, rates, and taxes	229,656 6 9	14,653 1 3	59,625 15 10	303,935 3 10
Salaries—management	17,707 14 10	2,236 15 2	4,754 10 1	24,699 0 1
Collectors' salaries and commission	35,649 4 1	3,096 6 7	14,932 19 4	53,678 10 0
Stationery, printing, and general charges	18,414 11 6	2,181 8 4	10,068 8 9	30,664 8 7
Directors and auditors	5,900 0 0	2,650 0 0	3,725 0 0	12,275 0 0
Salaries and wages, wear and tear—distribution	187,052 10 10	12,853 12 0	76,750 7 8§	276,656 10 6
Repair and renewal of meters and stoves	95,108 9 10	7,591 13 9	29,559 1 5	132,259 5 0
Law and parliamentary charges	4,469 1 7	147 16 9	3,686 6 2	8,303 4 6
Bad debts and extraordinary expenses	41,518 3 1†	1,930 16 5	26,894 16 7‖	70,343 16 1
Total expenditure on revenue account	2,547,292 0 11	267,526 18 0	938,027 19 8	3,752,846 18 7
Gross profit	997,960 16 8	90,697 6 2	332,194 2 2	1,420,852 5 0
Do. per cent. on capital and borrowed money	7 14 5	9 19 8	5 0 9	6 19 1
Do. do. gas-rental	35 5 6	33 0 0	35 19 2	35 5 6

* Stoves only. † Including £26,180 annuities. ‡ Capital converted under Act of 1896. § Including £6297 labour for gas-fittings.
‖ Including £6579 paid to pension, &c., funds, and £17,417 paid under profit-sharing scheme.

TABLE *showing the Capital, Income, Expenditure, and Profit, per Ton of Coal Carbonized (including Oil), in* 1896.

—	Chartered.	Commercial.	South Metropolitan.	All the Companies.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Capital and borrowed money	6 3 1·43	3 16 8·85	7 13 9·40	6 7 11·00
Income—viz.:				
Total gas-rental	1 6 11·36	1 3 2·60	1 1 6·44	1 5 2·60
Rental of meters and stoves	2·75	8·48	1 2·41	6·31
Residual products	6 5·66	6 2·82	6 8·79	6 6·29
Miscellaneous, including old materials	1·48	1·22	1·70	1·52
Total income from all sources	1 13 9·25	1 10 3·12	1 9 7·34	1 12 4·72
Expenditure—viz.:				
Coal and oil, including carriage and dues	10 11·76	11 3·80	10 2·62	10 9·60
Purifying materials, including labour	7·80	8·42	6·28	7·44
Salaries and wages—manufacture	3 7·93	3 8·87	2 8·03	3 4·80
Wear and tear—manufacture	2 11·05	2 10·11	3 1·14	2 11·54
Rents, rates, and taxes	2 2·25	1 2·85	1 4·68	1 10·81
Salaries—management	2·03	2·26	1·33	1·86
Collectors' salaries and commission	4·08	3·14	4·18	4·03
Stationery, printing, and general charges	2·11	2·21	2·82	2·30
Directors and auditors	0·68	2·69	1·04	0·92
Salaries and wages, wear and tear—distribution	1 9·38	1 1·03	1 9·48	1 8·79
Repair and renewal of meters and stoves	10·83	7·69	8·26	9·94
Law and parliamentary charges	0·52	0·15	1·03	0·62
Bad debts and extraordinary expenses	4·75	1·96	7·52	5·29
Total expenditure on revenue account	1 4 3·17	1 2 7·18	1 1 10·41	1 3 5·97
Gross profit	9 6·08	7 7·94	7 8·93	8 10·75

TABLE *showing Increase or Decrease in each Item during* 1896 *compared with* 1895.

—	Chartered.		Commercial.		South Metropolitan.		All the Companies.	
	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.
	£	£	£	£	£	£	£	£
Capital and borrowed money	755,700	..	28,445	..	3,102,844‡	..	3,886,989	..
Income—viz.:								
Sale of gas by meter	112,824	..	8,706	..	35,130	..	156,659	..
Public lighting, including lighting under contracts	1,277	..	154	..	1,029	..	2,460	..
Rental of meters and stoves	3,128	..	1,385	..	10,213	..	14,726	..
Residual products	..	97,290	..	10,310	..	28,337	..	136,536
Miscellaneous, including old materials	506	..	..	146	..	473	..	111
Total income from all sources	20,445	..	..	211	16,962	..	37,195	..
Expenditure—viz.:								
Coal and oil, including carriage and dues	..	26,904	..	2,340	6,910	..	..	22,335
Purifying materials, including labour	2,528	..	765	..	692	..	3,985	..
Salaries and wages—manufacture	17,421	..	706	..	4,132	..	22,259	..
Wear and tear—manufacture	12,295	..	..	1,287	..	15,243	..	4,231
Rents, rates, and taxes	18,719	..	1,835	..	14,782	..	35,337	..
Salaries—management	739	..	..	56	605	..	1,288	..
Collectors' salaries and commission	4,885	..	86	..	1,364	..	6,334	..
Stationery, printing, and general charges	2,684	..	356	..	..	201	2,839	..
Directors and auditors	..	..	..	..	37	..	37	..
Salaries and wages, wear and tear—distribution	3,517	..	..	906	374	..	2,983	..
Repair and renewal of meters and stoves	..	11,123	2,134	..	..	879	..	9,868
Law and parliamentary charges	1,974	..	..	317	2,132	..	3,788	..
Bad debts and extraordinary expenses	38	..	..	198	896	..	736	..
Total expenditure on revenue account	26,773	..	778	..	15,601	..	43,152	..
Gross profit	..	6,328	..	989	1,361	..	..	5,957
Do. per cent. on capital and borrowed money	..	£0 10s. 8d.	..	£0 8s. 9d.	..	£4 8s. 9d.	..	£1 13s. 5d.
Do. do. gas-rental	..	1 14 5	..	1 9 6	..	1 6 3	..	1 12 2

NOTES.

Street Lighting by Incandescent Burners.

Some interesting figures on the average life of mantles and chimneys in street lanterns have been given in recent communications to the "Journal für Gasbeleuchtung." The town of Darmstadt has 365 incandescent lights burning throughout the night, and 284 burning for half the night. They are lighted by means of a spirit-flame. The average life of a Welsbach mantle under these conditions has been found to be 597 hours, and that of a Jena glass chimney 1274 hours; only the time during which the burners are in use being taken into account. At Bromberg, a considerably longer life of mantles has been found with lanterns supported by wall brackets than with those on columns. The mantles on burners which were in use all night lasted nearly as many days as those on burners which were extinguished at eleven or twelve o'clock, and hence had a much longer life expressed in the number of hours during which they were alight. The Bromberg burners were lighted by the usual bye-pass pilot-jet. Taking all the street lanterns, the average life of the mantles was 56·7 days, or 359·7 working hours; and the average life of the Jena chimneys, 88·7 days or 563·7 working hours. The Engineer of the Bromberg works considers the conditions of street lighting in that town very unfavourable to the durability of mantles and chimneys; yet the total cost per lamp on the incandescent system is lower for all lamps alight after midnight than it was formerly with batswing burners. At Wiesbaden, the most recent figures give 638 working hours for the life of a mantle. At Duisburg, the average has been found to be 627 working hours; but here, as at Bromberg, it was found that the burners which were in use all night gave a better result, so far as the number of working hours was concerned, than those used for shorter periods only. Herr Schreyer, of Halle, computes, from figures obtained under various conditions, that the mantles of burners in use during the evening only have an average life of 300 hours, and those in use all night last 500 hours.

The Discovery of the Gases of the Atmosphere.

Professor W. Ramsay, F.R.S., has found it expedient, probably in response to multitudinous inquiries, to put together in book form all that is known concerning the discovery of the gases that compose the earth's atmosphere. This narrative of course includes the story of the discovery of argon—that remarkable component of the atmosphere which waited so long for recognition, and is so puzzling now it has been found. One of the peculiarities of argon, it is remarked, is the entire absence of anything about it of the "practical" kind, present or prospective. It is so far a mere scientific discovery; and the element, or whatever it is, does not possess a single feature calculated to arouse the interest of those people who are possessed by the notion that everything in the world ought to be good for something. Professor Ramsay explains clearly the preparatory work of Lord Rayleigh on the simple gases, and recounts the successive steps by which the disturbing element was tracked and isolated. He discusses the difficulty created by the anomalous characteristics of argon in respect of the periodic law. He compares elements possessing active affinities with argon and helium "the most indifferent of substances, the atoms of which are unwilling to pair even with themselves;" and he hazards the suggestion that in the former class of bodies "these powers of combination, due to some configuration or to some attractive force, tend to lessen the gavitational attraction by which we measure their atomic weights; that helium and argon, which possess little, if any, of such power to combine, show what may be termed the normal atomic weights, inasmuch as their gravitational attraction is subject to no deduction attributable to their reacting powers." This remarkable conjecture, pointing as it does to the assumed existence of some property of matter that may be called "levity," in contra-distinction to the idea of gravity, is as wonderful in its way as the newly-discovered elements of the atmosphere whose peculiarities suggested it.

The Latest Discovery in Physics.

Dr. Oliver Lodge recently described in the "Electrician" something done by a young Dutch physicist, Dr. P. Zeeman, of Amsterdam, as the latest discovery in physics. Like so many other "finds," this appears to have been met with in ground that had already been worked over without result. In the year 1862, Faraday tried an experiment (stated to have been his last), to ascertain whether the lines of the spectrum were in any way influenced when the source of light was in an intense magnetic field. He arranged a sodium flame to burn between the poles of a magnet, and then examined it spectroscopically from a direction across and also along the lines of force. The result was negative. At the end of last year, Dr. Zeeman made another attempt of the same kind as Faraday's of 1862; and, employing modern spectroscopic appliances, he succeeded in discovering a new phenomenon. The spectrum lines were observed to broaden when the magnet was excited. Sodium or lithium salts introduced into a bunsen flame burning between pointed poles, and the light examined by a large Rowland grating, will show the effect. An oxy-hydrogen flame is better than an ordinary bunsen one, because of the higher temperature. The phenomenon was corroborated by the result of further experiment, and was then published. Forthwith Professor H. A. Lorentz, of Leyden, stated that it accorded exactly with his own theoretical views, as a mathematician, concerning the nature of radiation; and he told Professor Zeeman that if he looked at the broadened edges of the lines he would find their light to be polarized. If he looked across the lines of magnetic force at the flame, he would see the extreme edges of the broadened sodium lines plane-polarized, with the plane of polarization coincident with the magnetic lines of force; but if he used perforated poles, and looked at the flame along the lines of force, then he should find the broadened edges of the spectral lines to be composed of circularly polarized light—right-handed on one side of the line, left-handed on the other. The whole of this prediction has been fulfilled to the letter. The importance of the discovery lies in its theoretical bearing, in the evidence it can furnish as to the nature of the motions which enable matter at high temperatures to disturb the ether.

TECHNICAL RECORD.

INFORMAL MEETING OF SCOTTISH GAS MANAGERS.

The Fourteenth Annual "Informal" Meeting of Scottish Gas Managers—convened as usual by Mr. J. M'Gilchrist, of Dumbarton—was held in the North British Station Hotel, Glasgow, last Wednesday. There was a fuller attendance than had ever been the case at any previous similar gathering. This was to a large extent to be accounted for by the presence of the Committee of the North British Association of Gas Managers, who had come to Glasgow for the purpose of making the presentation to Mr. R. S. Carlow, of Arbroath, their Secretary and Treasurer, and to Mrs. Carlow. Mr. W. Smith, the Manager of the Ayr Gas-Works, presided.

The Chairman's Address.

The Chairman opened the proceedings by delivering the following address:—

Mr. Convener and Gentlemen,—In the first place, allow me to thank you for the great honour you have conferred on me in appointing me to this chair, to preside over your meeting to-day. Fortunately for me, there is not so much required from the Chairman of this informal meeting as from the Chairman of the Association. All that is usually expected from the Chairman of this meeting, is that he will introduce some subject that may give rise to a very full debate. Before doing so, or beginning my address, allow me, with deep sorrow and regret, which, I am sure, is shared by you all, to allude to the sudden deaths of two of our most worthy members—Mr. John M'Crae, of Dundee, and Mr. Linton, of Leith. They died, as one might say, in harness—surely, an honourable death. You will, I am satisfied, not consider it invidious if I mention particularly Mr. John M'Crae, as he was so closely associated with us and with our meetings. At the last meeting we held in Glasgow he was with us, and took quite a lively interest in the debate. He was a kindly, genial man, and one who had always the courage of his opinions, and said straightforwardly whatever he had to say, without fear or favour. His familiar face and personality will long be missed among us. Gentlemen, with your sanction, I would ask the Convener to convey to both families letters of condolence from this meeting.

I think you will not consider it out of place if I tell you a little about the electric light in Ayr, seeing that the Ayr Gas Company is the only private company in Scotland that has to compete against electric light supplied by the Corporation. From the first I recognized that it would be a mistake to be antagonistic to the electric light, as, in all matters of this sort, the fittest is sure to survive. In this spirit my intercourse with all connected with the scheme has been carried through. I was always pleased to assist them in any way I could; and our relations have been altogether friendly, and are likely to continue so.

When the installation was finished, they prepared a grand opening. All the principal inhabitants were invited to a cake and wine banquet at the electric station, to witness the electric light being turned on, and to hear an address from Lord Kelvin, which came off all right. They were then to drive round the town, to see how beautifully it was illuminated. They did so, and searched diligently—some of them, I believe, with tears—but found no light. It had, unfortunately, again proved to be "the light that failed," as, through some simple thing which all the electricians could easily explain but could not help, there was no electric light. This, I am sorry to say, has been the history of the light ever since. It is continually going out at most awkward times—in the churches, in halls, and at public dinners. I must say it is very impartial, and treats all alike—people of all shades of politics. They go prepared for it now, and only laugh when anything goes wrong—it's only "Fanny's little way." But there would be a terrible outcry if anything went wrong with the gas.

I am very pleased to say that we have had the same experience as other places where electric light has been introduced—viz., increased consumption. You would naturally expect that, when the principal streets are lighted by electric lamps, there would be a decrease in gas used for that purpose. The very reverse has been the case. Formerly we supplied gas to 585 public

lamps; now we supply 443 (142 less). But the 443 have had larger burners supplied to them, and they are lighted during the whole winter, whereas formerly they were off for eight days during full moon; so that now there is a marked increase for public lighting. Because of that, and because gas is now being used for so many purposes—cooking, heating, power, and in innumerable other ways that we hear nothing about—our consumption increased last year more than 7 per cent., and during the last ten years upwards of 80 per cent.

About a year ago, we commenced to give all our consumers new burners free. This policy has been so successful with us that I have every confidence in advising you all to do likewise. You will find that if the consumers' gas bills are a little higher, they are more satisfied, as their light is so much better than when they were using unsuitable burners. We have also been enabled, from various causes, to reduce the price of gas, though our worthy Provost takes credit for that as being due to the electric light. I have heard it said that some people believe Tenterden Steeple had something to do with the formation of the Goodwin Sands. Well, I do not believe either of the statements.

About 85 of our consumers have adopted the electric light; but only four are without gas. Most of them have only a few electric lights in their windows; the other parts of their premises being lighted by gas. One, who has no gas, had to put in a gas-fire, the place was so cold. Altogether, their consumption of gas, which was upwards of 3,000,000 cubic feet, has been reduced by only 400,000 cubic feet in nine months, so that we have not felt any hardship from having to compete against the electric light; and from the returns from other places—notably Edinburgh—it is evident that there is room for both. No doubt the electric light will, in this age of invention, be improved, and may, at some future date, supplement gas to a greater extent in lighting; but by that time gas will be so much used for heating, cooking, and power, and the change will have been so gradual, that our industry will not be affected. We must also try to improve in everything connected with our business, so that we may be able to reduce the price of gas to such a figure that we need fear no opposition.

With this end in view, and in order to cause some discussion, as there is not anything controversial in my remarks about electric light, I have brought up a matter connected with our daily work which, though it may be old history, is to us of vital importance, and cannot be too frequently forced on our attention. It is the question of unaccounted-for gas. There is nothing that is a greater hindrance to our success, however well we may do in other ways. I believe myself that we have a great deal to learn about this question; particularly the reason why, when our consumption is doubled, as it has been by a good many of us during the last ten years, our percentage of leakage is not reduced, as one would naturally expect when twice the quantity of gas is passing through nearly the same pipes; for I think I am correct in saying that our mains have not been extended in anything like proportion to the growth of our consumption.

I have jotted down a few returns, extending over the last ten years, from works where there has been a considerable increase—showing that, though in many cases the consumption has been doubled, the percentage of leakage has not decreased in like proportion; and I assume the same measures were taken during 1896 as in 1886 to keep the leakage as low as possible. I have distinguished the places by letter only.

	Annual Manufacture, 1886. Thousands.	Leakage, 1886. Total. Thousands.	Leakage, 1886. Percentage.	Annual Manufacture, 1896. Thousands.	Leakage, 1896. Total. Thousands.	Leakage, 1896. Percentage.
A	27,000	4,050	15·0	44,000	7,744	18·5
B	24,000	2,400	10·0	50,000	5,015	10·3
C	38,000	6,560	17·0	65,000	10,230	15·5
D	51,000	8,160	16·0	85,000	12,805	15·2
E	34,000	2,380	7·0	54,000	4,320	8·0
F	184,000	18,400	10·0	251,000	22,590	9·0
G	45,000	4,635	10·3	100,000	16,000	16·0
H	58,000	6,670	11·5	96,000	9,600	10·0
I	21,000	1,260	6·0	45,000	6,075	13·5
K	185,000	21,635	11·7	315,000	36,855	12·7
	667,000	76,150		1,1 6,000	131,234	

After looking at these figures, one cannot help coming to the conclusion that we certainly have something to learn about unaccounted-for gas; and I hope the discussion will help to enlighten us a little. I do not make any apology for bringing up this old, old story, because it is one of such vast importance that time spent in learning a very little about it will be well spent. I have only touched on one salient feature in it, as it would be quite impossible to do justice to all the important points involved in a full discussion. I think if some large company—and there are many who could well afford it—would lay down a length of main pipe (say a few hundred yards) and pass gas from a high-pressure to a low-pressure main, measuring it at both the inlet and the outlet under different conditions, particularly variations of temperature, we should be very considerably enlightened on the subject, as then we might get an approximate estimate of the loss due to condensation and exosmose, and perhaps learn something on other matters on which we are at present ignorant.

And now, gentlemen, in discussing this subject, I would like it dealt with as a whole. We do not wish to know how much or how little each of us may have as leakage, as that depends very much on circumstances, but rather what means you have tried, or would suggest as likely, to reduce it, or, if not to reduce it, to account for it. I hope that we shall have an interesting discussion, and that from the experience of us all we may each learn a little that will be useful to us.

At the close of the first paragraph, the Chairman resumed his seat; and

Mr. J. M'Gilchrist (Dumbarton), the Convener of the meeting, said he would have pleasure in carrying out the Chairman's suggestion as to sending letters of condolence, in the name of the meeting, to the relatives of Mr. M'Crae and Mr. Linton.

Discussion.

Mr. A. Bell, sen. (Dalkeith), said he thought they were all very much indebted indeed to Mr. Smith for his most lucid address. He supposed that Mr. Smith's experience in Ayr was very much that of others all over the country—that where electric lighting had been introduced, there had been an increase in the consumption of gas. There was no doubt that, wherever electric lighting had been introduced, the increase had been more rapid than where it had not. This, he thought, might be accounted for by education. No doubt the eye became educated to light; and when a man had a brilliant light in his shop or office, he could not do with the dingy one at home with which he had been quite pleased before. It was the same with candles. The day was when they were all content with one candle; but nobody could live with one candle now—they must have half-a-dozen. And it was the same with gas. One thing about the electric light very much astonished him. This was the tremendous advertisements which were being continually written about it, which were backed by the most scientific names in the country, and which, of course, had a certain amount of weight. They were always telling them that they had got something up their sleeves. He was sorry to say that this had some weight with those who had the financial arrangements and the management of gas-works; and as to corporations, they apparently all of them feared that there was something which had not yet come out. Twenty-five years ago they experienced the same thing. They were still, however, able to hold their own; and so far from being antagonistic to the electric light, he thought they were quite the opposite. Personally, he had a great belief in the potentiality of electricity. They had not seen the end of it; nor had they seen the end of gas. If the electric light was going forward, so were they. There had been as much advance during the last ten years in gas as there had been in electricity. As to unaccounted-for gas, it was an old sore. It was difficult to see why, when they had doubled the consumption, the leakage should also be doubled. They knew very well that the gas, when passing through the purifiers, was at a much higher temperature than before; and he thought that Mr. Livesey had brought it before them that the unaccounted-for gas occurred at the meter. This would account for a good deal. He did not think the whole of it was leakage. They all knew that the public lamps were a source of loss to them. They were never paid for the full quantity of gas consumed in this way, whether the lamps were supplied by meter or otherwise. It was difficult to account for leakage. In his experience, it kept pretty steady. Everything that was gained in consumption lowered the leakage. He did not see why there should be any extra quantity unaccounted for, unless it were by condensation; and, of course, if gas were registered at the station meter, at a higher temperature than at the consumers' meters, a shrinkage would take place, because if there were aqueous vapour in the gas it would be deposited, and it would have been measured.

Mr. A. Yuill (Alloa) remarked that they all felt, in the matter of unaccounted-for gas, that there were some factors which were almost beyond their control. They could do all they might in dealing with the loss arising from fractured pipes or joints; but there were other factors at work. If they measured 1000 cubic feet of gas at what he might call the normal temperature of 60°, and on a winter's day it was passed through the consumers' meters at 32°, they would only have registered about 940 cubic feet. This was a loss which was outside their control altogether. They must also consider the barometric pressure. If the barometer were at 30 inches, and it fell to 29 inches, this would again affect 1000 cubic feet of gas to the extent of something like 40 feet. This, also, was beyond their control. Public lamps had always been a sore point in his experience. When they were dealing with an ordinary house supply, any defect which might arise would soon be put right; but, as they all knew, in public lamps, driven hither and thither by the wind, an escape might go on without them knowing anything about it.

Mr. T. D. Hall (Montrose) said that in the town where he resided they had got four private electric lighting installations; and they were threatened now with a London company, who were to light the streets for nothing. Since the electric light had been introduced into Montrose, the consumption of gas had gradually gone up, and was still rising; and they expected that when this London company started operations, they would have to put some new plant into the gas-works. He had given a great deal of thought to unaccounted-for gas. He never did believe, and he did not now, that unaccounted-for gas was gas which leaked into the street. If the millions of cubic feet that were unaccounted for went into the ground, he thought they would hardly be able to live in the neighbourhood. He did not think the matter of the pressure at which the gas was registered

had been touched upon. They knew that temperature had a great deal to do with the correct measurement of gas; but he believed that the pressure must also have a good deal to do with it. They knew that meters were tested and stamped when working at a pressure of about 5 10ths. They were also aware that gas was measured at the consumers' meters at a maximum pressure of, he would say, 2 inches; while, at the station meter, the minimum pressure might be 5 inches, and in the case of a large works it might be up to 10 inches. He thought that this low pressure of the stamped meter, and the very high pressure at the station meter, must have a great deal to do with unaccounted-for gas. Of course, they all knew that they were never paid for the gas that was consumed in, or leaked from, the street-lamps. The lamps being so high above the street, and with the gas ascending, an escape might go on for weeks before it was discovered—more especially if the lamps were lighted by a rod, when the lamplighter would have no reason to go above the burner with his nose.

Mr. W. Robertson (Campbeltown) asked how they were to account for what they got in their water-traps. He heard gentlemen say last year that they had no water in their traps; that the gas was too well condensed before it went out of the works. He required to pump his traps once a year; and he found a good deal of water in them. What was the residual product from this condensation?

Mr. J. B. Terrace (Brechin) said the vexed question of unaccounted-for gas had not been much out of his mind for the last two or three years; and he thought that reducing the illuminating power of the gas tended to increase the leakage. If they had gas of 30-candle power, and they reduced it to 24 candles, the increase in the make would be material; but the leakage would also be greater. They all knew that weak gas passed through a certain orifice quicker than richer gas. He used once to pump his traps every year; but he did not do so now. He was glad to say that he had got a good many of his leaky mains repaired. One of their traps, at the foot of High Street, which was at a low level, and required to be frequently emptied, had not been pumped for six or seven years. It was his experience, both in Brechin and in Dunfermline, where he learned gas making, that where gas came out rain water could get in; and when breaks were mended the leakage stopped. There was one place in Dunfermline where, after a shower or a rainy night, they had to go and pump the trap, but, of course, they would have got that remedied by this time.

Mr. W. Smith (Helensburgh) remarked that he had had a long extent of piping; and he had never pumped anything out of his pipes for ten or twelve years. He did not think that unaccounted-for gas was leakage; nor did he think it was condensation. He thought that it lay more with the meters than with either leakage or condensation.

Mr. A. MacPherson (Kirkcaldy) wished to say how much he homologated the Chairman's kind reference to their late departed friends Mr. Linton and Mr. John M'Crae. He thought they were all at one in their regret at the loss of such excellent members of the profession in Scotland. Mr. Smith's experience with reference to the electric light had been that of almost everyone where electricity had been introduced for lighting purposes. But a more important question for them was the unaccounted-for gas. There was not the slightest doubt that they could not compare any two towns in this matter. There were not two conditions the same. While some towns were well situated in regard to unaccounted-for gas, the position of others was bad; and to take a percentage over the gas manufactured was, he thought, very misleading. They must look at all the circumstances. Notwithstanding what had been said, he contended that a great deal of the loss through unaccounted-for gas was attributable to condensation. But they must take the mileage into consideration before they could make any comparison between different towns. There were other circumstances which must be borne in mind. Some places were undermined by coal workings; and, of course, these were more liable to have cracked pipes. Mr. Robertson, of Campbeltown, with his long experience and sagacious head, had struck a point they were apt to overlook, in the condensed water in the pipes. Some people said there was no condensation. He maintained that there ought to be condensation, because if they had gas at, say, 60° when it left the scrubber—and it was not safe to reduce it farther than this or else it would be at the cost of the illuminating power—it would be raised to a considerably higher temperature in the purifiers, if they did their work. It would be possibly 20° up; and if they were to measure it then, they would have a large volume of unaccounted-for gas. There was always aqueous vapour in gas; and the higher the temperature, the more it would carry. They would find it in the drip-boxes. They would discover that there was a good deal of condensation which could not be attributed to surface water. There was water in the traps at the inlet and outlet to their gasholders; and there were no means of surface water getting in there. They pumped a considerable quantity out of them every day. If they took a cubic foot of it, which would be 6¼ gallons, and converted it into steam, they would have 1728 cubic feet of steam. If, therefore, they pumped 6¼ gallons out of the drip at the inlet, this represented 1728 cubic feet of gas which had passed through their station meter, and which had never reached the gasholder. If they pumped more out of the drip at the outlet, and added them both together, they would find that a very large quantity of unaccounted-for gas had been produced by the condensation of aqueous vapour, which had been measured by the station meter. Then there was prolonged frost, or cold, which necessitated the selling of gas for a long period at a very low temperature; and this would increase the unaccounted-for gas, because if they measured the gas at 60° or 80° and sold it at perhaps 20°, this meant probably 10½ per cent., and in a works where they delivered very much the larger proportion of their gas during the winter time—such as in manufacturing towns—of necessity there would be a large loss. The watering of the meters, too, as Mr. Smith had said, had to be taken into account. The public lamps were a very fruitful source of loss. He knew that if a lamplighter found a cock which was stiff, he slackened it; and an escape went on for the whole 24 hours. The only remedy for this, he thought, was to put on a heavy lever weight, which would shut itself if it were slack; and this would compel them to have it put right. He had not found it to be his experience, as Mr. Smith had tabulated, that unaccounted-for gas had gone up commensurate with the manufacture. He had been able to increase his output of gas without the leakage going up in the same ratio. He thought they need not look at the unaccounted-for gas so long as they were satisfied that it was not going into the air; and, as Mr. Hall had very well said, if the millions and millions of cubic feet a year which were lost went into the soil, they could not turn up the ground without being suffocated. This clearly proved that it was not loss, but simply condensation, to a very material extent.

Mr. D. M. Nelson (Glasgow), as one who was not a gas manager, would not have spoken but for the fact that he thought one point had been overlooked. They would find that the loss of gas they would have at the consumers' meters would depend, to a great extent, upon the coal or shale they used. If they were carbonizing coal or shale which produced a lean gas, it would never reach the point of combustion, and they would find it ready to be pumped out of their drips; whereas if they were dealing with a coal which yielded a fat gas, it would not condense, and they would have the benefit of it at consumers' meters.

Mr. J. W. Carmichael (Barrhead) remarked that one point regarding public lamps had not been touched upon. If they had a lamp burner consuming 3 cubic feet of gas per hour, and the light was blown out by the wind, they would find that the burner would pass 4½ cubic feet of gas.

Mr. J. M'Gilchrist (Dumbarton) said he was sure they had had a very interesting discussion upon leakage; and he thought that was the only point which called for remark. He agreed with his old friend Mr. Smith from Helensburgh, who, by the way, had been a Gas Manager for fifty years. He started in Helensburgh, not only to make gas, but to lay the pipes and to fix meters, and to do everything pertaining to a gas-works; and his wife was able to keep the retorts going while he was outside. He thought, with them, that the great cause of leakage was the state of the meters. He believed that, if the meters were properly looked after, the leakage would be very greatly reduced. There was, perhaps, a tendency to fit in a meter, and to allow it to continue at work without inquiring very carefully whether it was still registering correctly. This pertained particularly to dry meters. Another point which had not been touched upon was that in recent years there had been an enormous amount of drainage going on. Sanitation seemed to be the *forte* of corporations at the present time; and they knew that if the contractors for the laying of sanitary pipes got about the gas-mains, they sometimes left them in a very bad condition. He had often wished that a remedy could be found for this. A point which he thought Mr. Smith did not do full justice to was where he referred to "A." and "B." and their increased leakage. They would think, from his argument, that the extent of the pipage was about the same; but they all knew that, in many cases, if the consumption increased, they had to extend the mains. And further, if the gas consumption increased, of course, with the same pipage they required an increase of pressure on the mains, which must be another source of leakage. While it was unreasonable to think that the percentage of leakage should remain the same if there was an increased consumption, he heartily sympathized with gentlemen who had charge of works where the manufacture of gas was decreasing. There was one case in his mind where, with a reduced consumption, the leakage was very much higher; and possibly there were gentlemen not intimately connected with the gas profession who criticized the increased leakage as if it were the manager who was to blame for it. The quantity of gas lost might be the same, while the percentage might be materially increased.

Mr. J. Renfrew (Langbank) said he would like to get a little information. A number of years ago he laid about half a mile of pipe for one consumer. In this length, there were five drips; and four of them were not sealed yet. Out of the other one, he had pumped about a gallon of tar. How did this happen? He had experience of pumping after a shower of rain; but in that particular instance, the drip was in a hollow of the road, and was always under water when there was rain. In that case he found a crack in the pipe.

Mr. W. Mackie (Port-Glasgow) said he was very pleased to hear that some were in such a fortunate position as not to require to pump their drips inside a twelvemonth. His experience, in the short time he had been in the works at Port

Glasgow, was that he had to pump them about twice a week. He knew the cause; it was greatly owing to broken pipes, of which he had found a large number. As regarded the electric light, he was very pleased to say that one shopkeeper in Port-Glasgow had adopted it. But he found that it cost him four or five times as much as gas had done; and after carrying it on for about six months, he now only used it on Saturdays, as an advertisement. Meters not being watered was a cause of leakage.

Mr. D. JEFFREY (Kirkintilloch) remarked that he had to pump his drips once a month at any rate, on account, he believed, of broken pipes and condensation.

Mr. R. S. CARLOW (Arbroath) said it was sixteen years since he went to Arbroath. At that time, the leakage of gas stood at 16¼ per cent.; last year it was down to 6·70 per cent. The cause of the reduction was their introducing good plant—such as condensers, scrubbers, and purifiers. No doubt there was a great deal in what Mr. MacPherson said—that leakage was caused by the registration at the station meter; but it was also just possible that they might register too high at the station meter, and in this way the leakage would be very much greater. He thought that if managers would look out for worn-out meters, they would find that it would pay to take them out and put in new ones, because the leakage would be reduced. He had substituted hundreds of meters in Arbroath; and the more he did so, the farther his leakage went down. They supplied their public lamps with Peebles's governor-burners; and he never had any complaint about them. He had put meters on along with the governors; and he could assure them that they got a fair return for the gas consumed in the public lamps. Their Chief Constable was careful to send them word of any escape which might be discovered; and this greatly helped him, because he could have it remedied at once.

The CHAIRMAN, in closing the discussion, said it had pleased him greatly. It had been very varied and very instructive. The gist of the whole of it, so far as he could follow, was that the greater part of the loss of gas was through condensation in mains—a reduction in bulk through a reduction of temperature, between the time the gas left the works and the time it reached the consumers' meters. It was monstrous to think that such a quantity of gas could be lost into the ground or the air in Glasgow as would supply a town of the size of Paisley. The liquor which was pumped from drips outside the works, he believed, was largely water which had accumulated in them through leaking into the pipes. He had drips which had not been pumped for years; and when he looked into them, he might find about a foot of tarry liquid, which had taken six or seven years to accumulate. In other cases, he might have to pump once a week, unless the weather were dry; and in those instances he thought the water got in by an opening in the pipe. He was sure the discussion had been very profitable to them all. It had shown them in how many ways unaccounted-for gas was really to be accounted for. He thought that in their annual reports they should not speak of unaccounted-for gas at all, but simply of the quantity of gas sold per consumers' meters, because there might be discrepancies in measurement. Some meters might register slow, and others fast; but there could not be any mistake if they were to say how much gas per ton of coal used they sold to consumers. He was pleased to hear the matter discussed as it had been, because it might be the means—which was his intention in bringing it up—of letting their directors and others know in how many different ways and circumstances gas might be unaccounted for, and how it might be larger in one place than in another, and not depend on the manager, but on circumstances beyond his control. He thanked them for the manner in which they had received his address.

BUSINESS.

The CHAIRMAN stated that Mr. M'Gilchrist wished to give up the convenership of the meeting. He had now held it for the last fifteen years; and it had entailed a great deal of labour. Probably he did not grudge this, but still the work was there; and he had now other work to do, which took up a great part of his time.

Mr. M'GILCHRIST said he had contemplated taking this step for some years past. He was much pleased to tell them that he he had got a very able successor to take up the duties in Mr. Yuill, of Alloa, whom he had great pleasure in proposing.

Mr. BELL seconded; and the suggestion was agreed to.

Mr. YUILL returned thanks.

Mr. M'GILCHRIST proposed Mr. Hubert Pooley, of Dunfermline, as Chairman for next year; and this was agreed to.

Votes of thanks were accorded to Mr. M'Gilchrist for his services during the past fifteen years; and to Mr. Smith for presiding.

PRESENTATION TO MR. AND MRS. CARLOW.

The company, to the number of about 100, afterwards dined together in the hotel. Mr. SMITH occupied the chair; and Messrs. MacPherson and Yuill acted as croupiers. A number of ladies were present. After the usual loyal toasts at the close of the dinner,

Mr. A. BELL, sen. (Dalkeith), said he had a duty to perform which he honestly confessed he would have liked to have shirked, but only for the reason that there were many there who were far better fitted than he was to do justice to it. However, he could at least claim this qualification, that he heartily sympathized with the object they had in view, which was to do honour to their friend Mr. Carlow, the worthy Secretary and Treasurer of the North British Association, and to present him with a tangible proof of their appreciation of his services. He was truly thankful that it required no eulogium of his to sound the praises of Mr. Carlow, seeing that he was known and respected by every member of the Association. They had heard the North British Association congratulated upon having always had good Secretaries; and he was sure they would all agree with him in this—that however good and efficient those in the past had been, no one had done better service than Mr. Carlow. It could easily be understood that the secretaryship of such an Association was no sinecure; but probably only those who were members of the Committee could fully appreciate the amount of work which the office entailed. No doubt they had often heard from Mr. Carlow that what work he had done for the Association had been a labour of love. Well, all he could say was that there was no accounting for tastes; but they must take his word for it, and, judging from his outward appearance, he was free to confess that the labours did not seem to have disagreed with him. Laborious, however, though his duties were throughout the year, they culminated at the time of their annual meetings. He therefore considered the suggestion a happy one, which coupled Mrs. Carlow's name with that day's ceremony, and he was sure it was with unfeigned pleasure they greeted her there that day; for he held that the Association was deeply indebted to Mrs. Carlow for the cheerful assistance she was ever ready to give the Committee in any endeavours to make their annual excursions pleasing and enjoyable to their lady friends. He had great pleasure, in the name of the Association, in presenting the gifts before them, along with a purse of money, to Mr. and Mrs. Carlow, as a token of their respect for them. As often as they saw them in their home, might the reflection come to them that they were accompanied by something even better than rich gifts—the regard and esteem of their fellows.

The gifts consisted of a drawing-room clock with side ornaments, a silver tea and coffee service, and a purse of gold.

Mr. CARLOW said he rose with the deepest and most sincere feelings of gratitude, to thank them for the very kind way in which Mr. Bell had spoken regarding Mrs. Carlow and himself. This was a red-letter day in their lives. He had no doubt that both Mrs. Carlow and himself would cherish the gifts to the end of their days, and would hand them down as heirlooms in their family. He had certainly great satisfaction in knowing that his services had been appreciated by the members of the Association. This mark of their appreciation would stimulate him to further efforts on its behalf. The Association was never in a healthier condition than at the present time; all the funds had a substantial sum at their credit.

Ex-Provost ANDERSON, of Arbroath, returned thanks on behalf of Mrs. Carlow.

Ex-Provost GRANT, of Arbroath, in proposing the toast of "The Informal Meeting," said it seemed curious to him that though gas managers were only servants who were paid for their labour, they should put themselves to the trouble they did, in connection with their business, in meeting and discussing what was to be for the benefit, not of themselves, but of their employers. He never knew of a body so banded together for the advancement of the industry with which they were connected as gas managers were.

WAVERLEY ASSOCIATION OF GAS MANAGERS.

The Seventy-second Half-Yearly Meeting of this Association was held at Haddington last Thursday. The members, of whom there was a good attendance, arrived at the pleasant county town by the forenoon train, and were met at the station by Mr. William Blair, the President of the Association, and the Manager of the local gas-works. Mr. Blair was accompanied by a gentleman whom it was worth going miles to see. The *doyen* of Scotch gas managers—Mr. Robb, formerly Manager at Haddington—exhibits, on the threshold of his ninetieth year, an intellectual vigour and freshness which is not often seen in men of half his age, and which made his presence enjoyable, especially in the later proceedings, when he acted as guide to the antiquities in the town. His chief occupation is now the study of antiquities, a subject on which he has published a book; and among other acquisitions which he picked up in the course of his quiet life in the retired county town of East Lothian, is a facility possessed by few in the deciphering of titles to properties written in the strange caligraphy known as engrossing, and couched in ancient Latin. Mr. Robb gave and received a very hearty welcome.

On their way to the meeting, which was held in the George Hotel, the members, on the invitation of Mr. Blair, inspected the gas-works, which are situated in near proximity to the railway station. As the construction of the works was referred to in the President's address, no detailed notice of them is necessary here. It may be stated, however, that in one corner of the works was to be seen an interesting memento of the famous litigation, which middle-aged readers of the "JOURNAL" may remember, on the question whether Torbanehill mineral

was or was not coal. Some of the mineral lay stored as a curiosity; and, as Mr. Blair explained, it was nearly resolved into its ultimate constituents on the occasion of the coal strike a few years ago, and was only saved from destruction by the timely arrival of a supply of coal when the very last charge had been made use of.

The business meeting was held at eleven o'clock—Mr. Blair in the chair.

The Secretary (Mr. J. D. Smith, of Selkirk) opened the proceedings by reading the minutes of the meeting held at Galashiels last September; and they were duly confirmed.

The President then delivered his valedictory address. He said it was sixty years last February since Haddington was first lighted by gas, which had continued up to the present time to be the principal illuminating agent, and was likely to remain so for some time to come. The Gas Company whom he had the honour of representing had, with the exception of the first year or two of their existence, been, from a financial point of view, fairly successful. They knew that in electricity and oil they had strong rivals; but of them they need not be afraid. He had often been twitted about the electric light going to do away with the demand for gas; but now that the public had got an inkling of the cost and vagaries of the light, they remained mute on the subject. The introduction of the incandescent gas-burner had given gas a still stronger hold as an illuminant; and, light for light, it out-distanced all competitors so far as cost was concerned. In the prepayment gas-meter they had another string to their bow, which enabled them to bring gas as a lighting agent within the reach of all in their districts. From the published reports of gas companies and corporations, the demand for gas for lighting, heating, and motive power was still largely on the increase, even in towns where the electric light had been introduced. This proved that the manufacture of coal gas had a longer lease of life before it than was predicted a few years ago. They lived in an age of progress and invention, and knew not how soon fresh discoveries might reduce the cost of electricity; but he was very doubtful if a reduction could be made in its cost proportionate to that which had taken place with gas in the last fifty years. During the past year, nothing new or startling had been introduced in the method on which they had conducted their various operations. It was seven years since the Association met in Haddington. The works were then in a very dilapidated state; in fact, the site on which they were placed was one of the worst possible—cramped in every way. All the material required double handling; and there was lack of storage for coal and lime—a state of matters anything but comfortable in ordinary times. He often wondered how they managed to pull through during the railway and the colliers' strikes. The retort-house on three sides was 10 feet below the ground-level, with numerous springs of water, which at times flooded the ashpits and furnaces. The old retort-house contained three ovens of threes, the retorts being round, 8 feet long and 14 inches diameter, and two single retorts 8 feet long and 24 in. by 13 in. They used to consider it good work to make 40,000 cubic feet per 24 hours with eight or nine retorts. The roof of the retort-house was a double span, resting on the top of the bench; the hydraulic main being raised on the opposite side of the bench and retort mouthpieces. The bench was built hard by the gable of the house, and had it almost on its broadside. This gable required to be taken down; and when they were at it he thought it advisable to carry it as far back as they could conveniently go to the gasholder. The wall-heads of the retort-house were raised 4 feet. A new steel roof now spanned the house, which measured 40 ft. by 52 ft. inside the walls. Mr. Blair next described the trouble he had with water. The site of the retort-house had been an old water-run; a stone culvert lying about 4 feet below the ground-level. He made up his mind to carry three 6-inch pipes with two feeders, right through the centre, to catch the water. They were fairly successful in securing a good foundation; and he had pleasure in testifying to the merits of concrete when made up of good cement, not reduced too much (about 3½ to 4), and about an inch of granolithic. The floor was good, having given every satisfaction since they started using it six years ago. One thing he should like to notice was that, in his opinion, they had carried the concrete too close to the retort-bench—18 inches. But it never interfered with it. He thought also that the surface would be too smooth and slippery for the workmen. In practice, however, he found it was not so, as there was always sufficient dust on the floor to keep their feet from slipping. He had every confidence in recommending concrete for its convenience as making the best sort of floor. Referring next to the retort-bench, Mr. Blair said that previous to coming to Haddington the bench in use with him had been on the regenerative system. He would have adopted there the Hislop system; but one thing against it was the cost. In a way of his own, he had an arrangement which he was glad to say was pretty successful. He described the process in detail. It appeared that the waste gases had two travels to the bottom; and as the secondary air entered at the bottom, he had an equivalent of three travels. He believed that in this way the whole of the secondary air from the waste gases was heated; and he had since learned from men of much greater experience than himself that they could borrow a little with advantage. On the whole question, he should say it greatly depended on the class or the quality of coke they had to deal with. In some instances, they would be unable to use the whole of the coke produced from the top retort. In his case, they were able to use four or five charges. In the winter time, for about two or three months, they made an average of 330,000 to 335,000 cubic feet of gas per week of 6½ days; for, with one or two exceptions, they were able to cease labour for twelve hours on Sunday. He should prefer to do without Sunday labour altogether. He liked to have a little rest himself, and he wished to afford those under him the same opportunity. So far as he knew and was able to judge, the retort-setting was a great source of profit to the Company. It gave pleasure both to himself and to the men. They worked with coal requiring them to clean their furnaces once in 24 hours. Mr. Blair next touched on the advantages of steam—describing the method by which he introduced it in the last travel; the result being that, in a sense, he obtained water gas. Regarding the washer, he stated that he had now a nice arrangement which enabled him to reduce the lime account, and add a few shillings to the tar and liquor account. As to his storage accommodation for lime, he had always been of opinion that one could not, with economy or advantage, bring out lime fresh from the shell and place it in the purifiers, and that it was well to have a little lime lying beside them. His Directors, always willing to extend the premises, had obtained ground which, while valuable for feuing purposes, at the same time enabled them to extend their storage room. As showing the desirability of having ample storage, he mentioned the circumstance referred to above, that during the railway and coal miners' strikes the last supply of coal was made use of; and it was only the arrival of a fresh supply by the next train that prevented the Torbanehill mineral from being used.

Mr. Black (North Berwick) having briefly spoken, and expressed his satisfaction at listening to the address,

The President took occasion to mention that the cost of the alterations he had referred to had been £2400. He added that they had been able since that time to reduce the price of gas from 5s. 5d. to 4s. 7d. per 1000 cubic feet. The alterations had been paid for out of revenue; and they were looking forward to being able to still further lower the price.

Mr. W. Whyte (Penicuik) said the President had touched on the question of electric lighting; and he (Mr. Whyte) could certainly bear him out in everything he had said regarding what was usually looked upon as their greatest opponent. He did not think they had anything to fear from the electric light. What they had to fear as a rival was paraffin oil. If they could bring gas within the reach of people buying pennyworths, they would find that it was these who made it pay—something like the third-class tickets on the railways. Gas managers ought to advise their Directors to go in as far as possible for an increased adoption of prepayment meters, and then they would be able to combat the greatest opponent they had—paraffin oil. He agreed with Mr. Blair's remarks as to the importance of storage accommodation. In his own case, he found that, having storage for only 32,000 cubic feet of gas, his men had to work to the utmost during the hours of darkness, and were comparatively idle during those of daylight. Mr. Blair had spoken of the use of concrete for making a floor; but he (Mr. Whyte) failed to catch whether or not he had built upon the concrete.

The President said they had it upon the authority of an English gentleman that if a certain heat were applied to concrete it would spring, and fall into powder. He was able, in a sense, to contradict this, as he found concrete stood in a very satisfactory manner.

Mr. Whyte (continuing) referred to the advantages of the semi-regenerator system for works of the size included within the district of the Association. He also endorsed Mr. Blair's good opinion of steam for pipe cleaning.

Mr. J. Richmond (Dunbar), referred to the fact that there was present with them Mr. O'Connor, whose opinion on the effect of heat upon cement had been alluded to; and he expressed the hope that an opportunity would be given to that gentleman to speak. Continuing the general discussion, he said that, with regard to automatic meters, the Burghs Gas Supply (Scotland) Act forbade the selling of gas at differential rates; and he thought the use of prepayment meters would necessitate differential prices.

Mr. Whyte said he did not think there should be differential prices in the case of prepayment meters.

The discussion on this subject was continued by Messrs. Richmond and Whyte; and the former gentleman also dealt with the question of the merits of semi-regenerator furnaces.

Mr. H. O'Connor (Edinburgh) said that, as his name had been referred to in the course of the remarks on the use of concrete, he might be allowed to say that, having superintended the laying down of he could not say how many thousands of tons of this material, he considered there was nothing finer for foundations. He believed, however, that it must be placed a certain distance away from any great heat; for no doubt heat on cement had the effect of cracking it. He proceeded to describe a case in his experience where this took place—where, he admitted, the cement might not have been quite so strong as that referred to by the President. In that case, as shown by Mr. Blair, the presence of water might have a tendency to keep the concrete cooler. By way of accentuating his remarks on this point, the speaker mentioned an instance where some concrete had become literally aglow with heat; some of the constituents of the material itself forming fuel for the combustion. He described

the chemical changes which took place when this occurred, and pointed out the prejudicial effect on the structure of different thicknesses of cement exposed to great heat, causing varying rates of expansions.

The discussion then closed; and Mr. Blair was awarded a cordial vote of thanks for his address.

The SECRETARY then read a letter received from Mr. E. Taylor, of Jedburgh, giving official notification of the death of Mr. W. Robson, of Selkirk, the originator of Gas Managers' Associations. Mr. Taylor, who was prevented from attending the meeting, dwelt upon the worthy character of the late Mr. Robson, and expressed surprise at the scant notice which had been taken of his life-work. He also stated that he had written to Miss Robson, in the name of the Association, conveying the sympathy of the members; and her reply was received at the meeting.

Mr. BLACK then moved the election of Mr. H. Rutherford, of Aberlady, as President for the ensuing year.

Mr. J. M'LAREN (Duns) seconded the motion; and it was unanimously adopted.

Mr. Smith was re-elected Secretary and Treasurer.

Mr. WHYTE suggested, seeing that the Association had two meetings in the year, that one of these should be held in Edinburgh, and the other, as now, in a provincial town.

It was agreed to favourably consider the suggestion at the next meeting, which is to be held at Berwick-on-Tweed in September.

The President, before adjourning the meeting, took notice of the presence of Mr. Robb, the "grand old man" among gas managers, who, he stated, was there in his 89th year, and who had seen 42 years' actual service as gas manager at Haddington. The President's reference to the venerable man was cordially appreciated by the members, who testified their regard for Mr. Robb. Under the guidance of that gentleman, the members before dining together visited the principal places of interest in Haddington, including the churchyard, in which is situated Lucerna Laudoniæ, one of the finest specimens of ecclesiastical architecture in the country, dating from the twelfth century. One half of the building has been restored, and is used as the Abbey Church; while the roofless walls of the other part enclose the graves of several notable persons, including that of Mrs. Carlyle, the wife of the Seer of Chelsea.

The members and their friends then returned to the George Hotel to dinner—Mr. Rutherford, the new President, in the chair, and Mr. Blair acting as Croupier. Mr. J. Black, of North Berwick, presented Mr. Blair with the President's medal of the Association. Several toasts were drunk, and one or two songs were contributed.

Afterwards, in charming sunshine, the company drove across country to the Earl of Wemyss' seat at Gosford, on the shores of the Firth of Forth. Mr. Rutherford had secured permission from his Lordship to view the handsome new mansion-house which has been erected at Gosford. They were received by the housekeeper, and spent an exceedingly pleasant hour in viewing the beautiful hall of the house and the art treasures on the walls. A stroll through the grounds brought the company to a singular looking building, of rough stones, which was found to contain the engines and dynamos for the generation of the electric current by which the house is lighted. Then refreshments were served, and three cheers were heartily given for the Earl of Wemyss in consideration of his having kindly thrown his house open to the Association. On leaving Gosford, the conveyances drove to Longniddry station, on the North British Railway, where most of the members found trains to convey them to their homes. The time for bidding good-bye was short; and some may have been unable to thank Mr. Rutherford and Mr. Blair for their kindness and attention. But if not spoken, all left Longniddry feeling that they had spent a profitable and agreeable day with the Waverley Association of Gas Managers.

THE RATING OF ENGINEERING UNDERTAKINGS.

At the Ordinary Meeting of the Society of Engineers on Monday last week, a paper on the above-named subject was read by Mr. P. MICHAEL FARADAY.

The author commenced by pointing out the importance to engineers of a knowledge of the method in which the works under their control are assessed for the purpose of parochial rating. He stated that the fact that most of our large engineering undertakings, being owned and worked by public companies, are assessed upon the receipts and expenses principle, is not a transgression of the law providing that trade profits are not to be rated. Also, that when rating an undertaking extending through many parishes, the assessment in any one parish must be fixed in accordance with the rental value of the hereditament in that parish, and not by ascertaining the value of the whole concern, and then dividing it among the various parishes claiming a share according to the size of the property in those parishes. The method of arriving at the rateable value of a hereditament on the receipts and expenses principle, the author stated briefly as follows: The gross receipts have first of all to be obtained; and from these have to be deducted (1) the working expenses, (2) the management expenses, (3) the Government charges, if any, (4) the rates and taxes, and (5) the rental value of dead works. The result obtained is the profit accruing from the undertaking. He went on to show that the "hypothetical tenant," who has, it is assumed, sunk capital in the concern, would then require a return by way of interest, &c., for his money; and a sum to represent this amount has now to be deducted from the gross profits to satisfy his claims, the residue being the amount he could afford, and would be willing to pay, the "hypothetical landlord" for his occupation—in other words, the gross value of the property. From this sum the usual statutable deductions are made—viz., those for maintenance, &c.—and the result will be the rateable value, upon which basis most of the taxes are paid. This is the principle adopted when assessing railways, canals, gas and water companies, &c.; and its application, though varying in some slight details as the character of the particular hereditament varies, may be taken to be practically similar in every case.

The author applied the above principle at some length to the rating of railways, and summed up the position as follows: On the system of most of the large railway companies, there is usually to be found one main or trunk line with several branches. Many of these branches are worked at a loss; but they are the means of bringing traffic to the main line as feeders, and as such they are material sources of wealth to the company. In the event of the whole system being contained in one parish, the difficulty of its assessment would be easily surmounted; but the parochial principle having to be adopted, owing to its running through many parishes, the local receipts and expenses are those only which can be taken into account. It follows, therefore, that in certain parishes, railway companies may be in the possession of property which contributes nothing to the local rates; for though there is undoubted value to the present occupier, the question which really determines the assessment is: What is the value of this property *per se* to a tenant if it were to let? The answer to this, of course, must be *nil;* for it would be impossible to find a tenant for a property of a trading concern the expenses of which exceeded its receipts. The railway company, however, do not gain from this cause, as they have to pay additional rates elsewhere. Should it so happen that in one parish there are two portions of line, one making a profit and the other working at a loss, the profits made upon the one line must first of all be devoted to paying off the deficit upon the other, after which the apportionment for the rateable value should be made.

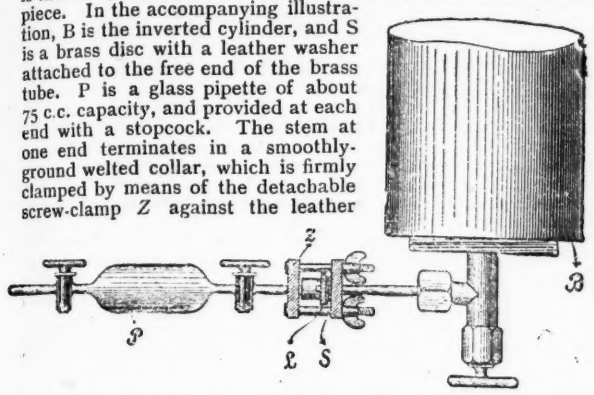
Passing on to deal with the valuation of a gas or water company, the author said the same method was adopted, though there was one difficulty less to contend with; for with regard to the "live" mains the parochial principle was only applied to a gas or water undertaking as far as the receipts are concerned. A valuation is made of the whole concern; and after the division between the dead works and the live works, the rateable value is apportioned to the several parishes in which the hereditament is situated, in the same proportion as the rateable value of the whole bears to the gross receipts of the entire undertaking. The great point of attack and the difficulties of defence in these cases, as in all others where the principle of receipts and expenses is adopted, is the tenant's capital. Water companies have great advantages over gas companies. The former have statutory rights to collect their rates in advance; and they generally avail themselves of the privilege. Obviously, therefore, an incoming tenant of a water company would require less capital than an incoming tenant of a gas company, for a gas company must manufacture their gas and deliver it to the consumer before receiving any revenue, with the small exception of that derived from the sale of the residual products; while a water company receive their income prior to delivering the water to the consumers. The author pointed out that this must have considerable bearing upon the question of the capital necessary to carry on the undertaking.

Mr. Faraday went on to show that the question of dead or live mains is one of considerable importance, both to the parochial authorities and to the company whose assessment is under consideration. He remarked that a gas or water company may have their works situated some distance away from where their product is consumed; and the carrying mains very often run through parishes in which there are no receipts. Again, in other parishes there are mains which are directly tapped for the convenience of ratepayers and others which are only conveying gas or water to some distant point of the district they serve. The division between these two classes of mains must be accurately made; for while the directly productive mains are assessed upon the receipts and expenses principle, the unproductive or carrying mains are assessed upon a percentage of their structural cost. The author said it would be impossible to lay down a rule that would be applicable in every case—indeed, probably every case would vary according to the size of the district supplied by the company; but it might be interesting and useful to note that, in the appeal of The Gaslight and Coke Company in so many parishes against the quinquennial valuation of 1890, the system adopted by the Court was that of treating all mains of 24 inches and upward as being unproductive or dead mains. The gasholders and retorts necessary for the carrying on of a gas undertaking, and the reservoirs and pumping-stations of a water company, are rateable at their rental value; and this value is derived from their structural cost. It has been sought to exempt gasholders and retorts as coming under the category of tenant's tools; but the fallacy of this contention was at once pointed out by the Court.

THE EXAMINATION OF COMMERCIAL LIQUID AMMONIA.

Reference was made in the "JOURNAL" for the 30th ult. (p. 711) to a method devised by Dr. Bunte and Dr. Eitner for the analysis of the liquid ammonia which is so extensively produced from gas liquor. We are now able to give details of their method.

The cylinder containing the ammonia which is to be tested is inverted, and a thin brass tube is screwed on to its mouthpiece. In the accompanying illustration, B is the inverted cylinder, and S is a brass disc with a leather washer attached to the free end of the brass tube. P is a glass pipette of about 75 c.c. capacity, and provided at each end with a stopcock. The stem at one end terminates in a smoothly-ground welted collar, which is firmly clamped by means of the detachable screw-clamp *Z* against the leather



washer and brass plate already mentioned. The pipette is accurately weighed, and then clamped to the brass tube; and, both cocks being open, some ammonia is passed through it to expel the air. The outer cock is then closed, and, by opening the valve of the cylinder, liquid ammonia is passed into the pipette until the latter is two-thirds filled. The valve and the second cock on the pipette are then closed; and the pipette is detached and weighed in order to ascertain the weight of ammonia it contains.

Three drying-tubes, charged with sticks of caustic potash, are then weighed. The pipette is set upright, and its upper stem is put in communication with the first of the drying-tubes, which are connected in series. The exit from the last tube is under mercury. The upper cock of the pipette is then gradually opened, and the ammonia allowed to slowly vaporize through the drying-tubes, and the vapour to escape by forcing the mercury seal. The moisture of the air will form a thick coating of ice on the pipette. The ice will disappear in a few hours after the ammonia has wholly vaporized. A few drops of brown liquid, consisting partly of water saturated with ammonia, and partly of organic substances of an alcoholic or tarry nature, remain in the pipette. When the latter has reached the ordinary temperature, it is placed horizontally in an air-bath at 160° to 175° Fahr.; and its inlet-stem is connected to a caustic potash drying apparatus. A stream of dry air is then drawn through the pipette; and the volatile organic compounds and the water are carried over into the first potash tube. A trace—not more than 0·08 per cent.—of brown organic matter, insoluble in ether and alcohol, but soluble in nitric acid and liquid ammonia, remains in the pipette. The increase in weight of the potash tubes and of the pipette gives the quantity of impurities in the ammonia taken. In one sample, 29·35 grammes of ammonia were taken; there remained in the pipette 0·0244 gramme, and the potash tubes collected 0·1193 gramme. The liquid ammonia therefore contained—

Organic substances of high boiling-point . . .	0·08 per cent.
Water and volatile alcoholic bodies	0·41 „

The total impurities in this liquid ammonia therefore amounted to only 0·49 per cent. This sample was from the Actiengesellschaft für Chemische Industrie of Rheinau.

USE OF ACETYLENE FOR BUOYS AND LIGHTHOUSES.

At the Meeting of the Institution of Naval Architects at the Society of Arts last week, a paper on "Acetylene Gas and its Probable Future Afloat" was submitted by Professor VIVIAN B LEWES, F.I.C., F.C.S., who is an associate member of the Council of the Institution.

The author commenced by referring to the discovery of the method of producing calcium carbide commercially by Mr. T. L. Willson and M. Moissan; and he then proceeded to deal with its properties, and its utility for generating acetylene gas, which in burning gives a flame of such intense brilliancy. He went on to point out that the possibility of liquefying acetylene at pressures about those at which liquid carbon dioxide is produced so largely, enables considerable volumes of gas to be compressed in the liquid state in small wrought-iron or steel cylinders; and in this condition it may be stored and burnt. The storage of the liquefied gas, however, presents an element of danger; and the occurrence of explosions during the past two or three years has given rise to a feeling that acetylene in this form is not safe. Professor Lewes stated that in each case the accident occurred owing to the screw-plugs of the cylinders being tightened up with undue violence. He expressed the opinion that, when the conditions of danger are realized, cylinders of liquid acetylene are, for all practical purposes, perfectly safe under rational treatment; and when it is considered that a cylinder holding a cubic foot of the liquefied gas will supply a burner giving a light of 32 candles for 400 hours, it is evident there are great possibilities for it in the future.

The author went on to remark that dreams of future development are but poor substitutes for practical applications; and there are certain spheres of utility ready for acetylene in which no plea of danger can be urged against its adoption. The first of these is for use in the floating buoys employed to mark the fair way in the estuaries and rivers that form the approach to many of our large trading centres. At the present time there are four methods by which these can be lighted: (1) Electricity, (2) compressed oil gas, (3) compressed coal gas enriched by gasoline, and (4) Wigham's oil-lamps. If electricity is used, the chance of the conducting wires being fouled by an anchor or dredge always exists; compressed oil gas needs a small gas-works and compressing plant; compressed coal gas and gasoline enrichment demand the latter, if not the former; while Mr. Wigham's oil-lamps stand out as being both good and economical. In Professor Lewes's opinion, there is room, however, for acetylene for this purpose; and a cylinder of liquid acetylene having a capacity of 1·75 cubic feet, fitted with a reducing-valve and stored in the bottom of a buoy, would give a clear white light of 32 candles for one month, and in cost would even now be about equal to compressed oil gas giving the same amount of light.

The author thought that if legal restrictions should prevent liquid acetylene becoming a commercial commodity, then compressed acetylene gas, in cylinders of the Pintsch or Pope pattern, could be effectively used; the gas giving a candle power three times as high as the best freshly-pumped oil gas. For such purposes as buoy lighting and for use in lightships, the cylinders of liquefied acetylene seemed to him to be especially adapted; while the still more important function of an auxiliary light for use in lighthouses would be best carried out with the uncompressed gas. For making acetylene for lighthouse use, &c., a small gasholder would be provided, and the gas passed into it from a generator in which the carbide is acted upon by water; the whole arrangement being so simple and rapid in operation that, even with the holder empty, gas could be made and the lamp burning within a few minutes of the breakdown of the electric lighting apparatus.

Of course, for all lighting and signalling purposes, the value of acetylene must be largely dependent upon the power which the light has of battling with atmospheric conditions. As long as the atmosphere is sufficiently free from mist to allow of the sun or the moon being seen apparently white, the illuminants now in use show no great diminution in their penetrating power; but as soon as a yellow or reddish tint begins to make its appearance, it is noticed that the electric light fades more rapidly than the light emitted by oil-gas or oil-lamp flames, as this yellower form of light seems able to penetrate the mist more successfully than the whiter light of the electric arc. This matter, it may be remembered, was referred to by Professor Lewes in the course of his last Cantor Lectures at the Society of Arts. On that occasion, he described how, by the creation of an artificial haze in a glass cell, he had been able to ascertain the percentage loss of light sustained by various illuminants in passing through it;* and he recapitulated the details in his paper before the Naval Architects. From the data yielded by these experiments, it was found that less light was absorbed from the yellow coal-gas and oil-gas flames than from the whiter acetylene flame; while this in turn was far superior in penetrative power to the Welsbach incandescent mantle or the light from the electric arc. The results were as follows:—

	Per Cent.
Coal gas	11·1
Oil gas	11·5
Acetylene.	14·7
Incandescent gas (Welsbach).	20·8
Electric arc	26·2

Of course, the foregoing figures merely give the loss of light which occurred in passing through the thickness of fog solution employed; but they also furnish approximately the ratio of the penetrative power of these illuminants in mist-laden air.

Oil Lighting by Constant Supply.—A system of lighting buildings by means of oil-lamps deriving a constant supply of oil from a central source, which has been more than once talked of, is now being introduced. The leading feature of the system is the employment of a main tank or reservoir, placed preferably somewhere outside the building to be lighted, and at a sufficient height to give the required head to feed the lamps. Between this reservoir and the lamps on each floor is provided an automatic governor for regulating the supply of oil. From this governor, pipes are led to the lamps, which are of special construction, inasmuch as they do not require a large oil-container—the usual source of danger in oil-lamps. The container need be only sufficiently large to keep the wick fully immersed in the oil; and there is, therefore, no space at all for the formation of explosive gases.

* See "JOURNAL" for Dec. 8, 1896 (p. 1128).

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Issue of Gas Capital at Par.

SIR,—In the leading article in the "JOURNAL" for the 6th inst., on "The Commercial Gas Company and their Capital," the following passage occurs: "The fact is, as the Chairman told the meeting, that no other gas company in the United Kingdom now has the power to issue fresh capital at par to present shareholders." I venture to point out that in the Filey Water and Gas Act, 1891, power is given to the Company to raise in respect of their gas supply the sum of £5000 (part of £20,000 authorized by the Act), and it is not trammelled by the auction clauses, but could be issued to the shareholders at par in the manner directed by the Companies Clauses Consolidation Act, 1845, section 58.

Malton, April 8, 1897. H. TOBEY.

The Relation between Water Supply and Enteric Fever.

SIR,—In a letter which I recently addressed you on the mortality from enteric fever in 1896 in relation to water supplies [*ante*, p. 417], exception may be taken to any inference which may be deduced from a single year's experience. But it is difficult to make satisfactory comparison over a series of years; for not only are the areas of supply constantly changing, but the sources of supply within the same areas, and even the treatment of water from the same source, has changed in recent years.

As the question of the water supply of London will shortly be brought under the examination of a Royal Commission, it may be of some interest to your readers to consider how enteric fever was distributed for the decennial period 1881 to 1890 in the registration districts of London. For the sake of comparison, I have assumed as before, and computed the death-rate from fever per million persons living in each registration district, with the name of the Company supplying water to the district:—

Death-Rate from Enteric Fever, 1881 *to* 1890.

London (whole of)	185	..	—
City	460	..	New River.
Strand	380	..	New River and Chelsea.
Hackney	360	..	New River and East London.
Whitechapel	340	..	New River and East London.
Greenwich	260	..	Kent.
St. Pancras	220	..	New River and West Middlesex.
Stepney	220	..	East London.
Lambeth	210	..	Lambeth and Southwark and Vauxhall.
Paddington	200	..	Grand Junction and West Middlesex.
Hanover Square	190	..	Grand Junction.
Islington	190	..	New River.
St. Olave's	190	..	Southwark and Vauxhall.
Hampstead	180	..	New River and West Middlesex.
Mile End	180	..	East London.
Fulham	170	..	West Middlesex and Chelsea.
St. Giles's	160	..	New River.
Bethnal Green	160	..	East London.
Marylebone	150	..	Grand Junction and West Middlesex.
Shoreditch	150	..	New River and East London.
Westminster	140	..	New River and Grand Junction.
Holloway	140	..	New River.
Wandsworth	140	..	Southwark and Vauxhall.
Camberwell	140	..	Lambeth and Southwark and Vauxhall.
Poplar	130	..	East London.
Chelsea	130	..	Chelsea.
Southwark	130	..	Lambeth and Southwark and Vauxhall.
St. George's-in-the-East	120	..	East London.
Lewisham	120	..	Kent.
Kensington	100	..	West Middlesex.
Woolwich	100	..	Kent.

According to this table, extracted from the Registrar-General's returns, the City, which is supplied by the New River Company, had the heaviest mortality; and Woolwich, supplied by the Kent Company, the lowest. But Greenwich, also supplied with the Kent Company's water, which has always been upheld as the standard of purity of chalk water, comes out fifth in the list as regards mortality. Whitechapel and Hackney (fourth and fifth) are supplied jointly by the East London and New River Companies; but St. George's-in-the-East, also supplied by the East London Company, has the same rate of mortality as Lewisham, which is served by the Kent Company. The districts supplied by the Thames Companies are for the most part below the mean for all London.

It will be noticed that districts having their water from the same Company vary considerably in the rate of mortality from fever. It is therefore evident that other considerations must be taken into account besides the source of supply. To what extent does water supplied by the Companies deteriorate after leaving the works? Is the method of storage adopted by the consumers at fault? Is it possible, and to what extent, for water under pressure in the mains to become contaminated by passing through a soil polluted by leakage from sewers? It was proved at Mountain Ash, in Glamorganshire, as a result of a Local Government Board inquiry, that water in the mains had become specifically polluted; and an epidemic of enteric fever was the consequent result. I have myself known water flowing through mains laid in a salt marsh to take up an increasing quantity of chloride of sodium in its transit, though the water in the mains was under a considerable head of pressure. In some of these registration districts, there are a large number of deep wells. To what extent may they have increased or diminished the rate of the fever mortality?

These are a few points on which it would appear most desirable that a thorough investigation should be made.

St. Mildred's House, E.C., April 9, 1897. A. H. SMEE, F.S.S., Deputy-Chairman and Chief Medical Adviser, Gresham Life Office.

The Lighting of Clacton-on-Sea.—Colonel Coke last Wednesday completed an inquiry on behalf of the Local Government Board, in respect of the application of the Clacton-on-Sea Urban District Council for sanction to borrow £5700 for town lighting and local improvements.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress had been made with Bills down to the adjournment of the House for the Easter recess last Thursday:—

Bills read the first time and referred to the Examiners: Ashford Urban District Gas Bill, Crowborough District Water Bill, Dublin Corporation Bill, Perth Improvements Bill.

Bill read a second time and committed: Weymouth Gas Bill.

Opposition withdrawn: Huddersfield Corporation Bill.

Bills reported, with amendments: Carnarvon Corporation Bill, Dumfries and Maxwelltown Water Bill, Huddersfield Corporation Bill.

Bills read the third time and passed: Newhaven and Seaford Water Bill, Torquay Corporation Water Bill, Tynemouth Corporation Water Bill.

Bills Royal assented: Crays Gas Bill, South Metropolitan Gas Bill.

The Rhymney Valley Gas and Water Company have presented a petition praying for leave to introduce a Bill to extend the period for the completion of the water-works authorized by the Rhymney Valley Gas and Water Act, 1892, together with a copy of the proposed Bill; and the matter has been referred to the Examiners.

The Eastbourne Corporation Water Bill, the Eastbourne Water Bill, the Fylde Water (Transfer) Bill, and the Swansea Improvements and Tramways Bill have been referred to a Select Committee, consisting of Lord Fermanagh (Chairman), the Duke of Newcastle, Lord Hopetoun, Lord Lawrence, and Lord Loch; to meet on Thursday, May 6.

The Standing Orders Committee have reported that the Standing Orders ought to be dispensed with in the case of the Southwark and Vauxhall Water Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills read the first time and referred to the Examiners: Clackmannan (Alloa and Tillicoultry) Water Supply Provisional Order Bill, Cowes Gas Bill, Newhaven and Seaford Water Bill, Paisley Water-Works Provisional Order Bill, Southwark and Vauxhall Water Bill, Torquay Corporation Water Bill, Tynemouth Corporation Water Bill, Tynemouth Gas Bill.

Bills read a second time and committed: Harrogate Corporation (Water Transfer) Bill, Harrogate Water Bill, St. Anne's-on-the-Sea Gas Bill, Taunton Gas Bill.

Bills reported: Arundel Gas Bill, Tuxford and District Gas Bill.

A petition against the Harrogate Water Bill has been presented by the Harrogate Corporation, and one against the Harrogate Corporation (Water Transfer) Bill by the Harrogate Water Company.

The London Water Question came before the House twice last week. On Tuesday, Mr. Buxton asked the President of the Local Government Board whether, with regard to the portion of the instructions to the Royal Commission on the London Water Companies under which they are to inquire and report whether the financial considerations of the question render it desirable that the undertakings of the Water Companies should be acquired by a public authority or authorities, he would state on what basis of purchase the Commissioners would be able to form an estimate of a fair price—whether on the basis of proceedings under the Lands Clauses Act, under the so-called "Plunket" clause, or under some other form of arbitration. Mr. Chaplin said it appeared to him that it would be for the Commissioners to form such estimates as they might consider necessary, and for that purpose to adopt such measures as they might deem desirable. They could, if they thought fit, form alternate estimates on different bases; but this was a question for the Commissioners to decide. On Thursday, Mr. Stuart had on the notice-paper a motion to refer all the London Water Bills of the present session to a Hybrid Committee, who were to be instructed to make provision in each of the Bills that if the undertaking of a Company were purchased, within seven years from the passing of the Bill, by any public body or trustees under statutory authority, the cost of purchase should not be increased by advantages conferred on the Company by the passing of the Bill. On the notice being reached, Colonel Lockwood said that, so great was the reasonableness of the East London Water Company and the hon. member (Mr. Stuart), that they had been able to come to terms on this subject, and to withdraw one clause and substitute another which met the views of the hon. member. He (Colonel Lockwood) hoped that, now the hon. member was fully convinced of the *bona fides* of the East London Company, he and the London County Council would assist instead of hindering them. Mr. Stuart thanked Colonel Lockwood for his courtesy. He said the hon. member had rightly described the circumstances, and it was not now his intention to include the East London Water Company in any motion on the paper.

HOUSE OF LORDS COMMITTEE.

Tuesday, March 23.

(*Before Lord* KNUTSFORD, *Chairman, the Marquis of* GRANBY, *the Earl of* STAMFORD, *Lord* WENLOCK, *and Lord* CLIFDEN.)

RHYMNEY AND ABER VALLEYS BILL.

After the rejection of the Caerphilly Bill (as reported last week), the Committee proceeded to consider the scheme promoted by the Rhymney and Aber Valleys Gas and Water Company.

Mr. BALFOUR BROWNE, Q.C., Mr. CLAUDE BAGGALLAY, Mr. JOSEPH SHAW, and Mr. TREVOR LEWIS appeared for the promoters. The various opponents to the Bill were: The Rhymney Urban District Council, represented by Mr. J. D. FITZGERALD, Q.C., and Mr. DICKINSON; the Rhymney Gas Company and the Bedwellty Urban District Council, by Mr. RAM;

the Caerphilly Urban District Council, by Mr. FREEMAN, Q.C., Mr. LEWIS COWARD, and Mr. MOON; Marquis of Worcester, by Mr. LITTLER, Q.C., Mr. COWARD, and Mr. DIGHTON POLLOCK; the Rhymney Iron Company, by Mr. LITTLER, Q.C., Mr. COWARD, and Mr. ASWORTH JAMES; the Tredegar Gas and Water Company, by Mr. WEDDERBURN; and the Caerphilly Gaslight, Coke, and Water Company, by Mr. FRERE. The London and North-Western Railway Company also petitioned against the Bill, but were unrepresented by Counsel.

Mr. BAGGALLAY, in opening the case, said the Bill was promoted by several gentlemen connected with the existing Rhymney Gas and Water Company, and others holding important positions in the district. The total amount of the capital sought to be raised was £200,000, of which £150,000 was for water and £50,000 for gas. It was proposed to transfer to the new Company five existing undertakings, of which the Rhymney Gas and Water Company was to be acquired, not by any money payment, but in exchange for shares to the amount of £19,180 in the new Company. It was also desired to take over the water-rights of the Rhymney Iron Company, the Rhymney Gas Company, the Caerphilly Gas and Water Company, and the New Tredegar Gas and Water Company. The object of the scheme was to maintain and construct works for the supply of gas and water to the parish of Gelligaer and the villages of Llangynider Bedwellty, Mynyddsllwyn, Bedwas Upper and Lower, Llanfabon, Eglwysilan, and other places in the counties of Glamorgan, Brecon, and Monmouth.

Evidence was then called for the Bill.

Mr. *M. Truran*, Chairman of the Gelligaer Rural District Council, and formerly Engineer and Manager of the Dowlais Coal Works, examined by Mr. SHAW, said his Council had entered into an agreement with the promoters for the supply of water in the parish of Gelligaer to the villages of Tontlottin Fochriw, Deri, Brithdir, Bargoed Hengoed, and other places. The upper part of the parish of Gelligaer was already satisfactorily supplied with water by the existing Rhymney Valley Gas and Water Company. Portions were also supplied from Merthyr, by the New Tredegar Gas and Water Company, and from an old colliery level. This was bad water. He had never tasted it; and he would not like to drink it, especially in summer. Part of the parish was also supplied with land water by the Rhymney Company; and this was not good water.

Mr. SHAW: As a colliery manager and mining engineer, what is your opinion about putting up reservoirs on coal measures?

Witness: My experience would not induce me for a moment to think of putting a reservoir of any size on them. In the future, Gelligaer must look for a water supply from the head of the Rhymney river. This is their only available source.

Cross-examined by Mr. FITZGERALD: A very large number of the houses in the Rhymney Urban District were small, with a rateable value of not more than £6. Even if the Rhymney scheme involved a considerable increase in the rates, he did not think the inhabitants ought to object, so long as they obtained a good supply of water. He did not know that the Rhymney Urban District Council were unanimously opposed to the Bill. If they could secure a good supply of water for £400 a year, it would be very cheap. They obtained water at the present time from the Rhymney Iron-Works.

Mr. LITTLER, on behalf of the Rhymney Iron Company, said he desired to remove the misapprehension that they were willing vendors.

Cross-examined by Mr. WEDDERBURN, witness said he did not know that the Company were bound to furnish water to such places in Gelligaer as they could supply by gravitation; nor did he know that they had made an agreement with the Bedwellty Urban District Council to give 200,000 gallons a day, which they could supply by gravitation.

Re-examined by Mr. SHAW: Wherever the New Tredegar Company obtained their water, all he knew was that they did not give a supply in the Gelligaer district; and when the District Council had appealed to the Company to help them through their difficulty, they did not do so because they had not the water to give.

Wednesday, March 24.

The following additional evidence was to-day tendered in support of the case for the promoters.

Mr. *Togarmah Rees*, M.Inst.C.E., examined by Mr. LEWIS, said he prepared the plans and estimates for the scheme. The works consisted of a reservoir to hold 190 million gallons of water; three filter-beds, capable of filtering 750,000 gallons per day; a service-tank immediately below the reservoir, with a capacity of one million gallons; and from the service-tank a 9-inch cast-iron main, over 8 miles in length, to Bargoed, where it would form a junction with the main belonging to the existing Rhymney Gas and Water Company. This would give a continuous connection from the head of the valley to the bottom of the district which it was proposed to serve, with the exception of a little bit less than a mile in length. This, he considered, was the only source from which a permanent pure supply of water could be obtained. The district proposed to be served extended from north to south a distance of about 15 miles, with a total area of 57·88 square miles and a population of 39,418, who would receive a supply of 20 gallons per head per day. This would amount to 788,360 gallons per day for the whole district, which would be ample both for domestic and trade purposes. He had made calculations extending over a period of 150 days, including last summer, that the dry-weather flow of the millstone grit amounted, on an average, to 200,000 gallons per day off an area of 500 acres. The average rainfall for three dry years amounted to 50 inches. Deducting 14 inches for evaporation and absorption, it left available 36 inches—or, taking the 500 acres, 1,116,000 gallons per day. Reckoning, as was usually done, that one-third should be given in compensation, that would amount to 372,000 gallons per day; but as it would be impossible to impound the whole flow of the river in times of flood, he thought the quantity of compensation water might fairly be reduced to 300,000 gallons per day. If this were done, it would leave available for the population 816,000 gallons per day; and as in times of excessive flood they would get one-third of the available rainfall from the limestone, in respect of which there would be no need to give compensation water, the total quantity available for the population would amount to 1,188,000 gallons. Starting with the reservoir quite full, and a dry-weather flow of 200,000 gallons per day, they could supply, in addition to the 16,000 gallons already furnished by the Rhymney Iron Company, a population of 58,333, at the rate of 20 gallons per head per day, and give 300,000 gallons of compensation water per day during a period of drought extending over 15 days. The present population was about 40,000; and it was estimated that they would be able eventually to supply 75,000, or nearly double the population of the whole watershed now without a supply. The works of the existing Rhymney Valley Gas and Water Company consisted of three tanks at Deri, with a conduit to Bargoed, and another conduit to Pengam, where it divided and went on one side in the direction of Fleur-de-Lis and Plas Cwmmr, and on the other towards Gelligaer. In addition to these, there was another tank at Llanbradach supplied from springs, which at present served a population of 6000. During the whole of last summer, though it was an extremely dry season, the supply was abundant. The Rhymney Iron Company had a reservoir holding 5 million gallons, together with two filter-beds capable of filtering 530,000 gallons of water per day, a service tank capable of holding 165,000 gallons, and distributing mains. All these works it was proposed to take over under the Bill. As the Rhymney Iron Company had numerous other small reservoirs which would not be taken, for supplying their collieries and works on both sides of the valley, the scheme would furnish the district with water without injuring the collieries and works.

Lord CLIFDEN: Is all this over and above what you have been telling us about before?

Witness: Yes.

The CHAIRMAN: Under the Bill I see you propose to take the whole of the reservoirs of the Rhymney Iron Company.

Mr. BAGGALLAY: Not the reservoirs employed for the purposes of their collieries or brewery; only those used for domestic supply.

Mr. LITTLER: It does not say so.

The CHAIRMAN: That will have to be made clear.

Witness: It is not for a moment intended to take the reservoir supplying the collieries.

Mr. LITTLER: I am bound to state that this is the first we have heard of such a proposal.

Mr. BAGGALLAY: All I can say is that in your petition you complain that we ought to take the whole of your water-works undertaking.

Examination continued: These existing sources of supply would prove of great service during the construction of the big reservoir. The works of the Tredegar Gas and Water Company and of the Caerphilly Urban District Council would be of very little service to the promoters. Having carefully examined the site of the reservoir at the head of the valley, he had not the slightest fear of its not being water-tight; and he did not anticipate any danger from putting an embankment of 100 feet upon this formation, because he had made a calculation that the millstone grit at the site of the reservoir was from 200 to 250 feet thick, and homogeneous in quality. The area of solid limestone was very large compared with that of the fissures; and however extensive the fissures were, there was sufficient millstone grit to hold. He based his estimate of cost upon the prices paid in the case of a similar reservoir which he had constructed at the head of the Sirhowy Valley, which was completed for £1000 less than his estimate. There was no reason why the cost should be greater in this case than it was in that. His estimate for the construction of the whole of the works and the land was £105,000.

Mr. LEWIS: The time for the completion of the works has been reduced to seven years. Is this an ordinary and reasonable limit for works of the kind?

Witness: It is less than is very often taken; but in my opinion it is quite reasonable, considering the circumstances.

The CHAIRMAN: For the reservoir alone, I understand you put down £80,000.

Witness: For the reservoir and land, £72,873.

Examination continued: He had assisted in the negotiations with the Rhymney Iron Company; and up to the middle of February he had no reason to believe that they were not willing to sell their water-rights to the promoters on terms. But suddenly, to his great surprise, the negotiations were broken off. The Rhymney mains were something like thirty years old; and some of them would require to be renewed. The only objection raised by the Rhymney Urban District Council was that they considered the rates rather high. They were the same as were authorized by Parliament in 1892; and were also similar to those the Caerphilly Urban District Council asked for in their Bill. The proposed works would be constructed at such an elevation as to supply by gravitation the whole of the populated portion of the watershed. They could easily reach a place as high as Bedwellty church. The New Tredegar Gas and Water Company failed to supply their district in this watershed last year. Things were so serious as to amount to a water famine, as there was no source of supply.

Mr. WEDDERBURN: We had the springs which flow from the side of the Brecon and Merthyr Railway.

Witness: Those are new springs to me. I am not aware of them. I know there is no other spring in any place in the district.

Examination continued: At Llanbradach, there was a sufficient supply at present. New pits were being sunk by the Tredegar Iron Company; and there were others being sunk lower down on both sides of the valley. When these pits were developed, there was certain to be a large increase of population, without counting the Windsor Collieries and the Universal Colliery, which would be another source of increased population. He was authorized by Sir William Lewis, on behalf of Lord Bute, who owned a large portion of Gelligaer, to say that his Lordship was favourable to the scheme.

Cross-examined by Mr. LITTLER: The reason why it was sought to transfer the supply of the Rhymney Iron Company was that the public preferred to get their water from a statutory company rather than from a private one. He admitted that some of the springs which supplied the Rhymney Iron Company passed through land belonging to the Marquis of Worcester. Others were on land belonging to the Marquis of Bute. He did not know that the amount spent in water-works by the Rhymney Valley Gas and Water Company was less than £5000.

Cross-examined by Mr. FITZGERALD: Under the Bill, the construction was to be spread over seven years; but the present sources of supply could be utilized until the works were completed.

Cross-examined by Mr. FREEMAN: He did not remember an instance in which a water company had obtained powers to go into a district against the wishes of the inhabitants. Nevertheless, he was not prepared to give up the idea of supplying the Caerphilly district.

Mr. BAGGALLAY: We have already offered to bring the water to the boundary of your district, and sell it to you in bulk.

Mr. FREEMAN: We do not want it at all. We have plenty of water of our own from various sources. Your works are not to be constructed for seven years; and it would be only then that you would be able to supply us at a fair price.

Mr. BAGGALLAY: We can do it at once.

Cross-examined by Mr. WEDDERBURN: The complaint against the New Tredegar Company was that they did not fulfil their statutory obligations last year. He was not aware that they had been urged by the merchants of the district to oppose the Bill. No doubt the New Tredegar Company could supply their own district with water by gravitation; but he did not know anything about the quality of the water. Many companies were in difficulties about their water last year, which was exceptionally dry; but it would not be true to say that the water companies in this part of Wales were in difficulties all round. The promoters had set aside £75,000 of capital to buy up the smaller companies; but he did not know how much was estimated for the Tredegar Company. He did not know that the Company paid a dividend of 10 per cent. on a capital of £10,000. If they did, it was not much to their credit to allow people to want for water. He was aware that they had done something to try and improve their supply; but it was not effective.

Mr. *G. H. Hill*, M.Inst.C.E., testified to the fact that there was nothing exceptional about the proposed reservoir.

Cross-examined by Mr. FITZGERALD: The estimate of the quantity of water coming off the 500 acres was mere assumption. It was impossible to make any accurate calculation by means of gaugings. He did not select the site of the reservoir, and he did not go on to the ground until the early part of the present month; so that the scheme was prepared and the plans deposited before his opinion was formed.

Cross-examined by Mr. JAMES: He was prepared to say that there were 500 acres free from swallow-holes. It would take five years to complete the reservoir. He had constructed two reservoirs with embankments as high as 100 feet.

Cross-examined by Mr. POLLOCK: Speaking with his Manchester experience of the difficulties which had to be contended with in the way of landslips, and so on, he did not think the cost of these works would very greatly exceed the estimate.

Re-examined by Mr. BALFOUR BROWNE: Any comprehensive water scheme for the supply of the district must take a considerable time to complete; and as no other body but the Rhymney and Aber Valleys Company had formulated a plan, the district would be kept waiting a shorter time by them than by anyone else. Twenty gallons per head per day would be ample in such a district. If properly administered, less than this quantity would suffice. In the Ystrad Valley, the quantity was only 12 gallons. The Caerphilly people only proposed to give 15 gallons a head.

By the Marquis of GRANBY: He had only paid one visit to the site of the reservoir; but he knew the surrounding district well.

By Lord WENLOCK: In a case of this kind, he did not think it necessary to ascertain absolutely the depth of the millstone grit over the limestone.

Mr. *J. D. Thomas*, who was formerly connected with the Rhymney Iron Company, expressed the opinion that, looking not only to the present but to the future prospects of the district, such a scheme as the one now proposed would not only be beneficial, but was absolutely necessary. The Rhymney Iron Company's charges for water were based upon the gross rentals of the cottages; whereas those of the Rhymney and Aber Gas and Water Company would be based upon the rateable value. In this respect, therefore, the tenants would get an advantage under the Bill. If such a scheme as that proposed were not sanctioned now, it would be absolutely essential at an early date.

Cross-examined by Mr. FITZGERALD: Nine-tenths of the ratepayers of Rhymney had not considered this question at all; and there were only 25 people present at the meeting which passed the resolution in favour of opposing the present Bill. The defects in the Rhymney water supply could no doubt be remedied by a small expenditure; but he took a comprehensive view in the interests of the people of the district generally.

Thursday, March 25.

The following additional evidence was to-day called on behalf of the promoters:—

Mr. *J. Jones*, Surveyor to the Gelligaer District Council, said that in consequence of the failure of the New Tredegar Company to supply them, his Council had spent nearly £1000 in endeavouring to obtain water for themselves; but as soon as their connections were made, the water disappeared. The water supplied by the New Tredegar Company in many places was very inferior; and it would be of the greatest advantage to the district as a whole to have a permanent and steady supply, not only for domestic use, but for the purpose of flushing the sewers. The total population of the parish of Gelligaer was now 16,000; and it was increasing at the rate of 1000 a year. The Dowlais Coal and Iron Company were sinking pits at Deri; the Rhymney Company, a little below Deri; and the Powell Duffryn Company, near Bargoed.

Rev. *A. Davies*, an Alderman of the Glamorgan County Council, expressed the opinion that, having regard to the probable increase of population, the only reliable scheme of supply was to get the water from the district above the coal measures. Most of the promoters of the scheme before the Committee he knew to be men of wealth and position. Some were well able to do the whole thing by themselves, if necessary.

Cross-examined by Mr. FITZGERALD: Personally, he would have no objection to see the Rhymney Urban District left out of the scheme. All he was concerned with was Gelligaer.

Cross-examined by Mr. WEDDERBURN: It might be possible to leave the New Tredegar Company as at present; but he preferred a comprehensive scheme which included all.

Cross-examined by Mr. JAMES: The water consumers might possibly be rated higher by the New Company than by the Rhymney Iron Company; but they would undoubtedly have a better supply.

Re-examined by Mr. SHAW: The Bedwellty District Council had entered into an agreement with the Tredegar Urban District Council to take water from them and sell it to the New Tredegar Company, who proposed to supply it to people in part of Gelligaer.

Dr. *Dyke*, Medical Officer of Health to the Gelligaer District Council, said the present supply of water in his district was very indifferent, very irregular, and in some instances impure.

Dr. *Williams*, Medical Officer of Health to the Glamorgan County Council, attending under a special order of the House, gave it as his opinion that, for purity of supply, the proper place to go for water for domestic purposes, as well as for colliery use, was north of the coal measures. So far as the water supplied by the Rhymney Valley Water Company was concerned, it was excellent.

Mr. *T. Bevan*, Manager of the Dowlais Coal and Iron Company, and Mr. *G. Seaborn*, a colliery proprietor from Hengoed, having given further evidence in favour of the proposals contained in the Bill,

Mr. *E. H. Stevenson*, M.Inst.C.E., was called. He concurred with the other engineers as to the desirability of putting the reservoir outside the coalfields, as was done in the case of Ystrad. The natural source of supply was certainly where the reservoir was proposed to be placed—at the head of the valley, so that all the buildings in the valley could be commanded by one set of works. The quantity of water obtained from the existing sources of supply throughout the valley was very small; and he was absolutely certain that for the future, if not for to-day, such a scheme as was now proposed ought to be carried out. He examined the reservoir in company with Mr. Rees and Mr. Hill; and he would have no hesitation of building an embankment of the kind proposed on the site selected. He had no doubt about the reservoir being water-tight; and he confirmed the figures which had been given as to the drainage area, the dry-weather flow, the capacity of the reservoir, and the compensation water. Caerphilly could be supplied from the existing sources during the construction of the proposed reservoir, by the completion of a short piece of main belonging to the Rhymney Gas and Water Company. It was a very simple matter, which could be carried out in a week or a fortnight. The immediate wants of the people higher up the valley could also be supplied during the time of construction, by an addition to the present mains of the Rhymney Gas and Water Company. There would be no difficulty, for instance, in supplying Brithdir from Deri. The capital of the Company—£200,000 in shares and £50,000 borrowing powers—was ample for the construction of the proposed works and for the purchase of the existing supplies. The amount of the water capital was £187,500; that of the gas capital, £62,500. In the case of the Rhymney Iron-Works Company—which was a non-statutory Company who had a reservoir upon coal lands, the lease of which must naturally be determined at some time or another—20 years' purchase of their net profits of £1100 a year was as much as could by any possibility be given to them, even supposing that some part of the money went to Lord Bute. The New Tredegar Company was a parliamentary concern, with a capital of £5000, which paid 10 per cent. on the original capital and 7 per cent. on the new capital of £1500. In their case, he had taken it at 25 years' purchase. There was no question that the Company were short of a supply; and they must either construct new works or buy water. In the latter event, the income would diminish; and with the former case, they would have to pay dividends upon a larger capital. Therefore 25 years' purchase of their income of £390 would be ample, in addition to the £600 of loan capital on the undertaking. He had gone through all the other concerns in a similar manner; and he put down for the Rhymney Valley Gas and Water Company £20,718, for the Rhymney Gas Company £20,000, and for the Caerphilly Gaslight and Coke Company £6000. The total amount required for the construction of the new works and the purchase of the existing undertakings was £144,350 in the case of water, and £41,448 in that of gas—leaving a margin of £43,250 for extensions of water-works and of £20,652 for further gas-works.

Lord WENLOCK: Do your calculations include 10 per cent. for compulsory purchase?

Witness: If the Arbitrator gave that, it would have to be added.

Cross-examined by Mr. FITZGERALD: You do not seem to have allowed anything for the expenses of the arbitration?

Witness: My experience of arbitrations is that they do not amount to much nowadays. All questions of principle have been settled long ago; and now it is only a question of price.

Have you ever constructed a reservoir on a site similar to that selected here?—No.

Cross-examined by Mr. FREEMAN: In view of the fact that the capital of the new Company would be a 10 per cent. capital without auction clauses, while new capital raised by the Rhymney Valley Gas and Water Company would be a 5 to 7 per cent. capital with auction clauses, there must be under the Bill some postponement of a reduction in the price of water to the consumer. What he had said related to gas as well as to water.

The CHAIRMAN: As nothing has been said about the gas up to the present time, it will be very much more convenient to keep to the water. Besides, the Committee will require to deliberate upon the water case before proceeding with the gas.

Mr. BALFOUR BROWNE: The gas question will probably only be a matter of clauses.

Cross-examined by Mr. WEDDERBURN: If the New Tredegar Company paid 10 per cent. on a capital of £10,000, they had made very misleading returns to the Board of Trade, because the whole of their capital expended up to 1895 was £5864, of which £400 was premium. He had not heard of a fresh issue of shares last year, which brought the capital up to £9900. If that were so, its dividend would probably not amount to anything like 10 per cent. now.

Cross-examined by Mr. JAMES: The nearest swallow-hole was about half a mile above the reservoir. If the Rhymney Valley suffered in the matter of higher water-rates, they would benefit by getting a thoroughly good supply.

Mr. *R. Forrest*, Agent to Lord Windsor and a Director of the Windsor Collieries and of the Barry Dock, said that, being convinced of the necessity of a proper supply of water for the district, he had become a promoter of the scheme which was put forward. The gentlemen associated with him were also largely interested in the district, and were animated by similar motives. He had no doubt that if the Bill was passed, the money would be raised and the scheme carried out.

Cross-examined by Mr. WEDDERBURN: During the construction of the works, the shareholders would not get any interest.

This concluded the case for the promoters.

Mr. FREEMAN, without calling any evidence, thereupon addressed the

Committee, on behalf of the Caerphilly Urban District Council, in opposition to the scheme, which he characterized as an absolute departure from established practice and usages, inasmuch as the promoters were seeking to come into a district against the will of the local authority, who were desirous of obtaining a supply of water for themselves. The Caerphilly District Council viewed with the most extreme alarm a scheme which would deprive them of the protection of the Public Health Act, and one under which they could only get 26,000 gallons of water a day—a quantity which was ludicrously insufficient for their wants.

Evidence was afterwards called on behalf of the New Tredegar Water Company.

Mr. *N. Phillips*, a Director of the New Tredegar Company, said that by means of the new works which they had put down, the Company would certainly be able to supply Bedwellty and part of the Gelligaer district. The rates proposed by the Bill would be in every case higher than those charged by the New Tredegar Company.

Mr. WEDDERBURN then proposed to call the County Analyst to speak as to the quality of the New Tredegar Company's water.

Mr. BALFOUR BROWNE: There is no question about the quality.

The CHAIRMAN: I understood that it was admitted to be good.

Mr. BALFOUR BROWNE: Our case in this matter is based upon quantity, not quality.

Friday, March 26.

At the commencement of the proceedings this morning, it was stated that Lord Granby was unable to attend, owing to an attack of influenza; and it was agreed to continue the evidence in his absence.

Mr. WEDDERBURN said that after the announcement that no attack was going to be made on the quality of the water, he would confine himself to the question of finance.

Mr. *Baldwin Latham*, M.Inst.C.E., was then examined. He said he had made an inspection of the district supplied with water by the New Tredegar Company, and visited the sources of supply, of which there were four—two on either side of the valley, practically at the four corners of the district—from which the water was conveyed into pipes by gravitation. Except in abnormally dry weather, the supply of water from these sources and from the coal measures was ample, and of very good quality. In very dry weather, of course the streams were liable to be affected in volume; but there had never been an absolute scarcity of water in the district. He had made himself conversant with the terms of the agreement entered into by the New Tredegar Company and the Bedwellty Urban District Council with regard to obtaining a supply of water from the Tredegar Urban District Council. Bedwellty made no profit; and the Water Company supplied and distributed the water on the same terms as they received it. There was no difficulty in laying the pipe from the filter-beds of the New Tredegar Company, which command a new water supply in addition to their old supply; so that there would be no fear of the district being short of water at any time.

Cross-examined by Mr. BALFOUR BROWNE: In times of drought, there was not sufficient water; but he had been told that there had never been an absolute scarcity. From his knowledge of springs in these strata, there was sure to be considerable fluctuation in the flow; but he had never gauged the springs.

Mr. *W. B. Keen*, F.I.C.A., expressed the view that the amounts allowed by the promoters for the purchase of the various undertakings would not be sufficient. For example, the amount assigned to the New Tredegar Company was quite inadequate, having regard to the price to be paid to the Rhymney Gas and Water Company. The financial position of the new Company would be a very bad one, inasmuch as they would have a very large capital on which they would require to pay dividend; and the undertakings which they were purchasing would not, on the basis of the present figures, yield anything like a dividend on the capital unless there was a very enormous increase of population. It was very unusual, and very bad finance, to deal with the borrowing powers at the outset. He found that the New Tredegar Company had recently made a very considerable expenditure upon works; and in the past three years there had been an increase in their dividends from 4 to 10 per cent.

Mr. BALFOUR BROWNE in cross-examination: Supposing they get a fair number of years' purchase of their revenue, they will not suffer?

Witness: They may not.

On the one hand, if they get the full amount of their maximum dividend, they will be fully compensated; and, on the other hand, if it is a thoroughly good concern and we purchase it at a fair price, we shall get the value of our money?—Quite so.

Mr. WEDDERBURN, addressing the Committee on behalf of the New Tredegar Company, argued that the scheme was without precedent, without necessity, without warrant, and without use.

Mr. PEMBER, for the Bedwellty Urban District Council, asked that the duty of supplying water in the district should not be taken away from the Local Authority, and placed in the hands of those whom the Council did not select, and against whom they had a very strong feeling. The result of so doing would be to largely increase the cost to consumers.

Dr. *J. D. James*, Medical Officer of Health to the Bedwellty Urban District Council, said that in his opinion the arrangement entered into with the New Tredegar Company and the Tredegar District Council would ensure an abundant supply of first-rate water.

Mr. *J. A. Sheppard*, Clerk to the Bedwellty Council, gave corroborative evidence.

Mr. *Baldwin Latham*, recalled, said the height of the top-water above Ordnance datum was 1411 feet; and the drainage area which rose up to a level of over 2000 feet, was partly on the millstone grit and partly on the carboniferous limestone, in which there was a very large number of swallow-holes. The site selected was a most improper one for the construction of an embankment 100 feet in height, as there were clear indications of a direct channel communicating between the swallow-holes above the site of the reservoir and a very large spring, of an intermittent character below the site of the reservoir. When he examined this spring early in February, it was flowing at the rate of millions of gallons a day; and within a week afterwards there was only a trickle coming through, which showed that the water found its way by this subterranean passage direct into the stream on the proposed site of the reservoir, and came out below. He took the temperature of the water in this spring; and he found that it was 43·2°; while the water in the stream was 37·3°. This difference indicated that the water had gone down to a considerable depth underground. He thought it showed that there was a deep passage under the site of the reservoir—a most dangerous formation upon which to construct a reservoir of the size proposed. If any catastrophe were to happen to the reservoir, it would be attended by the most serious results in the valley below. The inevitable result would be that the whole of the Powell Duffryn Collieries would be flooded; and the same thing would happen if a large quantity of water required suddenly to be let down out of the reservoir to prevent a catastrophe.

Mr. BALFOUR BROWNE, in cross-examination: Where did the water get this accession of temperature in passing underground? It must have gone down a good way?

Witness: No, it need not, because the temperature 50 feet below the surface is about the mean temperature of the air.

How many degrees are calculated for each hundred feet of descent into the earth?—About 2°; 1° for every 52 feet after 50 feet in cases where the temperature of the ground is usually the mean temperature of the air of the place.

How many feet would the water have to go down to raise its temperature from 37° to 43°? Do you suggest that it would go down 364 feet?—Nothing of the sort, because the temperature 50 feet below the ground is about the same as the mean temperature of the surface of the ground in this district—namely, 45°.

Have you ever made a single experiment with reference to the temperature of the earth 50 feet below the surface in this district?—No, not in this district. It is a recognized rule.

Have you erected any water works situated on a millstone grit formation?—I have carried out similar works in Devonshire, only that there we have not got the carboniferous limestone.

Do you not know that the Longdendale works supplying Manchester are made in the millstone grit?—Yes; but they have not got the carboniferous limestone.

Will you say that it is not below the millstone grit?—If it is, it does not appear.

Can you tell me the thickness of the millstone grit over the carboniferous limestone in Longdendale?—I do not know.

Mr. *E. M. Hann*, Manager of the Powell Dwffryn Steam Coal Company, said they employed 3000 men at the colliery; and they were sinking another pit, which, upon a moderate computation, would employ about 1600 more. The valley contracted just above the New Tredegar Colliery; and got narrower, until it became nothing but a mountain gorge, with very steep sides. Under these circumstances, if anything happened to the embankment of the reservoir, just above, the result would be fearful.

Mr. *W. L. Marks* and Mr. *L. Vine*, speaking for the Rhymney Urban District Council, characterized the proposed works as being absolutely unnecessary; and said that the Council were unanimous in their opposition to the Bill.

Mr. *R. Hassard*, M.Inst.C.E., examined on behalf of the Rhymney Iron Company, considered that a more unsatisfactory site for a reservoir could not have been selected; and he gave it as his opinion that the drainage area upon which the promoters were relying for their supply of water was not 500 acres, but 220 acres. This, taking 32 inches as the available rainfall, would give 456,000 gallons of water per day, instead of the 1,116,000 gallons calculated upon.

Mr. BALFOUR BROWNE: If that is so, you would not be entitled to one-third of the 1,116,000 gallons as compensation water.

Mr. *A. Strachan*, a member of the staff of the Geological Survey, attending under a special order of the House, said the reservoir was not placed in such a position as to take full advantage of the geological formation and the natural resources of the district; and it was put upon ground which was probably not sound, owing to the existence of swallow-holes, which intercepted the water above the reservoir. In consequence of these swallow-holes, something like 700 acres out of 920 acres of the catchment area would fail to supply the reservoir with water. He believed that there was direct communication between the fissures in the intermittent springs and the swallow-holes, and that there were other fissures under the site of the reservoir. He could not explain in any other way the fact that the stream was three times as large at the site of the dam as it was at the head of the reservoir.

Mr. BALFOUR BROWNE, in cross-examination: Did you put in salt or petroleum, to see whether there was direct communication between the springs and the swallow-holes?

Witness: No, because I understood that the water was used for domestic purposes.

Mr. BALFOUR BROWNE: If you had done as I suggest, it would have been conclusive as to whether the water came through.

The CHAIRMAN intimated that at the conclusion of the evidence of the opponents, the Committee would on Monday call upon Counsel for the promoters, in replying, to direct their special attention to the objections to the scheme which had been raised by the three urban districts, and to the buying up of a statutory Water Company against their will.

Monday, March 29.

On the re-assembling of the Committee to-day,

The CHAIRMAN intimated that Lord Granby was again unable to be present; and therefore the Committee proposed, at the conclusion of the cases for the opponents, to consult the wishes of Mr. Balfour Browne as to proceeding with four members.

Mr. SHAW said the promoters were prepared to continue before four members.

The CHAIRMAN: If after hearing Mr. Balfour Browne there is any want of unanimity among members of the Committee, we should think it only right to give him an opportunity of re-arguing the case before the full Committee.

Mr. LITTLER said that, in view of the fact that their Lordships had indicated that they did not desire to hear any evidence on behalf of Lord Worcester, he had carefully considered the case of the Rhymney Iron-Works Company; and though there were certain matters which he should have liked to set right, he had come to the conclusion that, on the whole, the Committee were sufficiently in possession of the facts of the Rhymney Iron-Works Company's case. Under these circumstances, he did not propose to call any further evidence. Proceeding to address the Committee in opposition to the

scheme put forward by the promoters, the learned Counsel further emphasized the contention that it was an absolutely unprecedented proposal that a private Company should undertake the water supply of a district against the will of more than one of the local authorities, and against that of the Rhymney Iron-Works Company, one of the largest owners of property in the district, who were doing their duty by their own house property entirely apart from their position as vendors of water elsewhere. It was now sought to take from the Company that which enabled them to obtain a higher rental for their houses—namely, the water—and by the simple device of abolishing an old Company and starting a new one, the promoters were seeking to obtain for themselves the whole of the prospective value of the water undertaking of the Rhymney Iron-Works Company without vouchsafing a single word of explanation as to their reasons for so doing. Why was it not proposed to extend the limits and increase the capital of the old Company? Because the promoters of the new Company wanted to make the new capital into a property which they might sell in the future at the utmost profit to themselves. The Rhymney Company owned in this valley no less than 6300 acres, of which 2300 acres was in the upper part, and consisted of some of the best gathering ground. Of this the promoters proposed to take, as they calculated, 500 acres, but as he maintained only 220 acres, with the object of supplying the valley; and yet at the end of seven years, they only proposed to give a very limited supply of water. The Rhymney Iron-Works Company were of opinion that the site selected, being on the millstone grit, was an extremely dangerous spot upon which to construct a reservoir with an embankment which was admittedly of an usual height; and, as property owners, they looked with considerable apprehension upon the creation of a reservoir of the dimensions proposed at the head of the valley. As a ground for this apprehension, Counsel ventured to point out that among reservoirs of large size on which serious accidents had happened, three—one at Huddersfield, another at Sheffield, and the third in Wales—were on the millstone grit. The site selected in the present case was the spot where such a catastrophe was likely to occur; and he urged the Committee to avoid such a risk, unless there was a pre-eminent necessity for what was sought to be done. In the case of the Sheffield Company, so terrible were the results that it was necessary to appoint a Special Commission for the purpose of ascertaining the compensation; and in the end, the Company were obliged to obtain power to increase their charges by something over 50 per cent.—a most serious thing for the consumers.

The CHAIRMAN: This only goes to show that there was great damage done by the bursting of a reservoir.

Mr. LITTLER: And moreover that there was a great increase in the price of water. Proceeding, he remarked that it was not as though the promoters were going to supply a quantity of water sufficient for all time, but only as a makeweight; and in the meantime they were going to rely entirely upon buying the water undertaking of the Rhymney Iron-Works Company, who had abundant water which they could utilize. In these circumstances, why should they be deprived of their watershed simply because someone came along, not with an efficient scheme of water supply, but for that which, spread over the whole district, would be a mere trifle. The proposals of the Bill would involve an increase of £364 in the water-rates of Rhymney; and to this extent either the tenants must suffer or the Rhymney Iron-Works Company must lose the amount, besides running the risk of having their coalpits flooded out if any such accident as they apprehended occurred to the reservoir. The Bill, the passage of which would prevent the Rhymney Iron-Works Company coming to Parliament next year for power to supply the whole of the district, appeared to be founded on the theory that the promoters could cajole the Committee into sanctioning a scheme which could not be of any possible value to anyone. It was worse than worthless—it was reckless; and he asked the Committee not to pass it. On behalf of the Marquis of Worcester, he would content himself with saying that his Lordship had the strongest objection to the scheme in his own interests, as well as in those of his tenants.

Mr. BALFOUR BROWNE, replying upon the whole case on behalf of the promoters, said that so far as the opposition of the District Council was concerned, they had simply "rung the changes" on the fact that the proposal of the Bill was unprecedented. This was one of the weakest arguments that could possibly be addressed to a Private Bill Committee. As regarded precedent, he pointed to the case in which a Committee presided over by the late Lord Derby passed a Bill for the purchase of the Sheffield Water Company, though they had done their duty; giving as the reason for their decision that it was on the ground of public policy. The Duke of Buckingham, who was then Chairman of Committees, as well as Lord Morley, the present Chairman of Committees, took exception to a Committee passing a Private Bill on the ground of public policy, because they held that such a case should be dealt with in a Public Bill. He (the learned Counsel) asked the Committee to deal with the Bill before them, not as a matter of public policy, but on the merits of the particular case. From the beginning to the end of the valley, which comprized 58 square miles, there was not a single landowner opposing, with the one exception of Lord Worcester, who would obtain ample compensation under the Lands Clauses Act for his land. He would remind their Lordships that, in the case of the Caerphilly Bill, four landowners, holding one-half of the whole district sought to be supplied, were opposing; whereas in the present instance, out of 58 square miles, there were 34 square miles represented by the Gelligaer Local Authority, who were in favour of the scheme. Out of a total population of 38,400, 18,550 were in the Gelligaer district, which was admittedly in sad want of water. The local authorities opposing were the Caerphilly, Rhymney, and Bedwellty District Councils. Caerphilly had shown that there was an absolute necessity for a water supply in their district, by coming with the scheme which the Committee had condemned, and by which it had been proved that, for the time being, they must get their water in one way or another from the existing sources of the Rhymney Company, and that in the end they must go up to the top waters of the stream. Under the Rhymney Valley Water Company's Act of 1892, part of the rural district of Caerphilly was given to that Company against the will of the local authority, because there was an absolute necessity for a supply of water which the local authority were not in a position to give. In 1891, the Bedwellty Local Authority opposed the Western Valleys Water Bill; but notwithstanding this, the Company obtained power to supply a portion of the Bedwellty district. There were therefore cases of precedent in this very district. The promoters would give the District Councils every possible safeguard to ensure their obtaining a proper supply of water; and the new Company were willing to have their action limited in such a way that, in case of failure to supply, the District Council should not be barred for all time from supplying themselves. With this object in view, the promoters were prepared to assent to a clause similar to that which was inserted in the Bill of 1892, providing that, if at the end of five years the Company failed to supply water, the local authorities should come in. In the case of the Tendring Hundred Water Company, four local authorities—one of them being the Corporation of Harwich—opposed; but Parliament gave powers to the Company limited to five years. The promoters had already made what they considered a fair and generous offer to the Caerphilly District Council—namely, to deliver to them water in bulk, and let them supply themselves. But for the Rhymney Iron-Works Company, he did not believe the Rhymney District Council, whose opposition was principally upon the question of rates, would be opposing at all. The Rhymney Iron-Works Company was a non-statutory Company, in whose case it was *ultra vires* to supply at all, inasmuch as the water was given to them by Lord Bute for the purpose of their work.

Mr. COWARD: That is not so; and I have all the leases here to prove it.

Mr. BALFOUR BROWNE said he would carry the matter no further than to point out that the Rhymney District Council were leaning upon a broken reed; and he would do in their case as he had already done in that of Caerphilly—offer to let them have water in bulk, if they chose to supply themselves, and leave it to an Arbitrator to say what should be paid. As regarded the Bedwellty District Council, whose case was to a certain extent mixed up with that of the New Tredegar Company, they had already conceded part of their district on the west side of the valley to the Rhymney Valley Company in 1892, because they were not able to supply themselves. Of course, the Committee would see that an injustice was not done to the New Tredegar Company; but the Chairman of the Bedwellty Local Authority gave evidence that he had no objection to the rates of 1892, which were the same as those now proposed. To everyone of these local authorities he would say the same: "Whenever you choose to come and ask for water in bulk, you shall have it on arbitration terms." In this way they would make certain of getting a supply of water while they were not in a position to supply themselves; and whenever they were able to supply themselves, they would have the means of obtaining water in bulk. Turning to the case of the Rhymney Iron-Works Company, whose desire was to come to Parliament with a scheme of their own next session, he asked why they should be trusted with the power of supplying water more than the promoters.

The room was then cleared; and on the re-admission of the Counsel and parties,

The CHAIRMAN said: The Committee have carefully listened to what Mr. Balfour Browne has so ably put before us; but the unanimity of the Committee has not been shaken, and we have come to the conclusion that the preamble of the Bill, so far as the proposed water supply is concerned, is not proved. Do you propose to go on with the part relating to gas? Perhaps it is hardly worth while.

Mr. SHAW: No, my Lord; we will not proceed with the gas portion of the Bill.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Tuesday, April 6.

(*Before Mr. Justice* ROMER.)

Incandescent Gas-Light Company, Limited, v. Marsden.

This was a motion which has been adjourned from time to time, to commit the defendant for breach of his undertaking.

Mr. TERRELL, Q.C., who represented the plaintiffs, said his clients had received a letter from the defendant's Solicitors saying that, after seeing the affidavits further filed on behalf of the plaintiffs, they had advised their client not to contest the matter further; and it would be unnecessary for the witnesses to be in attendance.

Justice ROMER asked if a committal was pressed for.

Mr. TERRELL said it was; and he should ask his Lordship to make a severe order. The defendant had put in affidavits in answer to the motion which he could show were deliberate perjuries.

Justice ROMER said he must see the affidavits.

Mr. TERRELL accordingly read one of the defendant's affidavits, in which he denied that he had sold the mantles referred to in plaintiffs' affidavits, or authorized his servants or agents to do so. He said that at the time of the alleged sale he was in Birmingham; and that it was untrue he had ever competed with the plaintiff Company, or that he had dealt in mantles, either in the Provinces or London, since Dec. 18, 1896, or that he had appointed any agents for the sale of such mantles. The learned Counsel then read the affidavit of Rachmel Friesh, in which he narrated his dealings with the defendant; and also one by Miss Pugh, who was present at several of the interviews between defendant and the last witness, and confirmed his statements. Other affidavits were made by Mr. J. I. Elliott and Mr. T. W. Dowler.

Mr. HINDE then shortly addressed his Lordship on behalf of the defendant; saying that he was now very sorry for what he had done, and that he had a sick wife.

Justice ROMER, in giving judgment, said this was one of the grossest cases of contempt that had come before him. The defendant, well knowing the undertaking he had given, had deliberately and intentionally broken it, and then sought to prevent the plaintiffs finding out what he had done, and to escape from the consequences of his acts when the motion was made, by deliberately stating on oath that which was not true. Comment would be thrown away on the proceedings of a man like this. He should simply order him to be committed for contempt, without at present limiting the time of his imprisonment. He should wait to see how matters went on, and whether, after a time, the defendant applied in a proper spirit to be released. At present he should simply order him to be committed, and to pay the costs of the application, to be taxed as between solicitor and client.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, April 5.

(*Before Baron* POLLOCK *and a Special Jury.*)

Fox v. Jerome and Others—The Water-Gas Libel Case.

This was an action brought by Mr. Samson Fox, the Managing Director of the Leeds Forge Company, Limited, against Mr. Jerome K. Jerome, the Editor of "To-Day," Mr. Dunckerley, the publisher, and Messrs. Wyman and Sons, Limited, printers of the paper, in which the plaintiff sought to recover damages for a series of alleged libels published therein. The nature of the libels was indicated in the "JOURNAL" last week.

Sir EDWARD CLARKE, Q.C., M.P., the Right Hon. H. H. ASQUITH, Q.C., M.P., Mr. H. F. BOYD, Q.C., and Mr. COLEFAX appeared for the plaintiff; Sir FRANK LOCKWOOD, Q.C., M.P., Mr. BIGHAM, Q.C., and Mr. DANCKWERTS represented the defendants.

On the resumption of the hearing of the case to-day,

Mr. *Samson Fox* was again cross-examined by Sir F. LOCKWOOD. Dealing with the subsidiary Companies of the British Water-Gas Syndicate, witness said the Nottingham and Derby Water-Gas Company refused to complete, and showed a general disinclination to start business. The British Syndicate brought an action for the specific performance of the agreement to take a licence to work under the water-gas patents; and they asked that the Notts and Derby Company might be restrained from passing a resolution to wind up voluntarily. The Notts and Derby Company put in a defence, in which they alleged that he (witness) and Cottam had made material misrepresentations that all the patents were valid; whereas it was alleged that both he and Cottam knew them to be invalid, and that water gas was not a commercial success, and had not been used on a large scale. The plaintiffs sought to have the contract carried out, and claimed £100,000; but the action was settled on the defendants paying £15,000.

Sir F. LOCKWOOD: Why did you compromise? You were charged with misrepresentations, and with having deceived those gentlemen at Nottingham?

Witness: I think they went into liquidation before that. It was considered that, as they were in liquidation, it was the best thing to close the matter for a sum they were willing to pay.

Without trying the very important questions as to whether you had been guilty of misrepresentation?—I do not think that governed us.

Witness (continuing) said he was present with Cottam at a meeting of the board of the Notts and Derby Water-Gas Company at the Holborn Viaduct Hotel, in May, 1889, at which the Notts Company were asked to pay an instalment of £30,000 off the payment for the licence. To this proposal, they demurred. He did not hear Mr. Cox, one of the Directors, inform the meeting that Cottam had just said: "For God's sake let us have the £30,000, because we have over £170,000 to find in differences over the water-gas settlement." He never heard that till now; and it was not said in his hearing. He met the Directors of the Notts and Derby Company after that; but he did not complain that they did nothing to keep up the water-gas shares.

Sir F. LOCKWOOD: Did the Chairman of the Company tell you that the capital of the Company was to do business with, and not for gambling?

Witness: He did not say that.

Did the Notts and Derby Directors repeatedly complain to you that no plant was sent to Nottingham?—Mr. Cox wanted a plant built and put down at his works. Mr. Alderman Goldsmid was the Chairman of the Notts Company.

In further cross-examination, witness said he did not authorize a telegram to be sent by Cottam to Mr. Goldschmidt asking the Notts Company to buy £20,000 of British shares. He disapproved of the telegram; and he did not hear of it until some time after it had been sent.

Sir F. LOCKWOOD: Could that application have been made to the Notts and Derby Company for any other purpose than to bolster up the Syndicate shares?

Witness: I do not know. It might have been intended for that purpose; but I am a total stranger to the telegram.

The learned Counsel put in a telegram from "An Interested One" to the Secretary of the Notts and Derby Company dated May 20, 1889. It ran: "What are your Company about? You deserve to go to the d——. Every other Company is supporting our property, with beneficial results; and you will suffer. You deserve to be crossed out, and will be if you do not take action."

Witness: I was very much annoyed that anyone should take such a liberty as to send that telegram. Mr. Kirk was a Director of both the Notts and Yorkshire Water-Gas Companies.

Witness was shown a letter written by Mr. Kirk to Mr. Goldschmidt, stating that the Yorkshire Company had put orders on the market for £10,000 of Yorkshire shares that day. Witness said he generally disapproved of the letter; but he could not say whether he had expressed his disapproval to Cottam.

Sir F. LOCKWOOD: Notwithstanding all these documents, Alderman Goldschmidt and the Notts and Derby Directors stood firm not to take up your licence, and would not buy the shares of the Syndicate.

Witness: Yes. On May 21, 1889, Mr. Kirk had a letter from Alderman Goldschmidt, in which the latter said: "Whilst I will loyally and faithfully fulfil my duties with the British Water-Gas Syndicate, I will not be a party to Stock Exchange transactions of any description." I have no fault to find with that, it seemed to me that something was going on that I did not understand; but I cannot say that I asked for an explanation. I got Mr. Wilson, the Manager of the British Water-Gas Syndicate, to send a telegram to Nottingham on May 28, asking that the Directors should pay a sum of money on account, so that the Notts and Derby Company could take up their licence.

In further cross-examination, witness said he was told that the North British Company, of which he was a Director, were approached by the Notts and Derby Company to stand out with them against completing the contract; but he was not present at any meeting of the Directors at which it was mentioned. He had never heard that the North British Company agreed to stand out, and that then some influences induced them to go on. He got very little information from the inquiries he made. The Uddingston works were some 20 miles out of Glasgow, and belonged to the Chairman of the North British Company—Mr. J. R. Stewart. Before he became Chairman, he sold them to the parent Company for £15,000. The parent Company first used these works on the 12th of May; but they had not been paid for. No one valued them for the parent Company. He had heard that they cost less than £15,000; but they were good value for the money. He had walked over the works. Stewart was a shareholder in the parent Company; and he got his price without any independent valuation. Stewart took them back six months ago, after the amalgamation. Mr. Donald Graham was originally a Director of the North British Company; but he sent in his resignation nine days after the Company was registered, in May, 1889. On May 27, some of the allottees of shares in the North British Company were beginning to grumble; and it was arranged that witness should purchase £15,000 of shares, and hold them as trustee for the parent Company. Up till December, 1889, there was no advertisement of that transaction. Witness took the shares at par; but as the North British owed money to the British Syndicate, no money had to pass, and consequently there was no publicity.

Sir F. LOCKWOOD read an agreement of Aug. 22, 1889, under which Cottam was to get £75,000. He asked witness what this sum was for.

Witness said the North British Company agreed to pay him £75,000 for promoting the North British Company. The receipt was to be given by Cottam and his assignee (witness), because witness had advanced £70,000 to Cottam in return for the assignment of Cottam's rights under the promotion agreement. Witness did not advance the money himself; it was found by the Clydesdale Bank, of which Mr. J. R. Stewart was a Director. Witness went on to say that the Syndicate were buying the shares of the dissentient shareholders with the money that was being paid to them by the North British Company for the purchase. Actions were brought by Reynolds and three gentlemen named Webb, alleging that there had been misrepresentations on the part of the parent Company; and the Board of the North British Company passed a resolution not to pay anything more to the British Water-Gas Syndicate in respect of the licence. He did not know that at this time complaints were being made that there were misstatements in the North British prospectus. Reynolds and Webb wished to be taken off the list of shareholders; and the actions were settled by the shares being taken over at par, the payment of the costs, and the names being struck off the register. It was thought better to settle, having regard to the larger action against the Notts and Derby Company. He was advised that he was sure to succeed in regard to these actions, but that the matter was so small that it was not worth defending. On May 10, 1889, a resolution was passed by the Syndicate indemnifying the North British Directors from any personal responsibility they might incur in going to allotment after the retirement of Mr. Donald Graham; and the Syndicate at the same time declared that the statements made in the North British prospectus, so far as they were extracted from and based upon the British Water-Gas Syndicate's prospectus, were true in substance and in fact. At that time complaints were not being made of misstatements in the prospectus.

Sir F. LOCKWOOD: Did you ever disclose to the shareholders of the Syndicate that actions alleging misrepresentation had been brought against you by complaining shareholders, and that you stopped the actions by paying for the shares and defraying the costs?

Witness: I do not remember having done so.

If you had not stopped these actions, would not the North British Company have joined the Notts and Derby Company and refused to complete?—The North British Company were intent on going through. The charges of fraud were withdrawn.

Witness was then asked, with reference to a number of telegrams sent by his son-in-law, Mr. Bagshaw, to his stockbrokers for the purchase of shares, whether the shares were bought for him. He said they were not. The "joint purchase" of May 18 was entered into by five or six persons—himself among the number. Prices were coming down very speedily; and the object of the purchase was that if a few thousand shares were bought, it would probably stay the downward tendency. The shares were bought in his name; and the reason for this was that the brokers preferred having his name for payment than a bunch of names.

Tuesday, April 6.

Mr. *Fox*, in continuation of his cross-examination, said he had had 10,000 £5 vendor's shares in the British Water-Gas Syndicate allotted to him. £22,000 of these went to the members of the little Syndicate formed to float the Company; and £16,000 worth to Cottam as part payment for the promotion of the Company. The little Syndicate found £10,000 in cash towards the £40,000 he (witness) agreed to provide. The subscribers to the little Syndicate did not get any cash returned, because they preferred taking shares. At that time, it did not appear likely that the shares would become worthless. In the experiments at Leeds Forge, to which a number of gentlemen were invited, one furnace was used. The charge was made up of 70 per cent. of pig iron and 30 per cent. of scrap steel. It was not right to say that there was a larger percentage of the scrap, for the material could only be made by the 70 and 30 percentage. Water gas was produced at Harrogate for his private purposes, at a price ranging from 1s. 2d. to 1s. 10d. per 1000 cubic feet. The cost varied with the price of coke; but the highest price was certainly not 15s.

Sir F. LOCKWOOD: Can you tell of any place, other than the Leeds Forge, at which water gas has been produced in this country at a cost of 4d. per 1000 cubic feet?

Witness: Yes, at Belfast every day.

Since when?—During the last eighteen months it has been produced at under 4d. per 1000 cubic feet.

Is that produced for illuminating?—It is; but the 4d. does not include distribution. The manufacturing cost is taken when the gas enters the holder.

Has the electric light been produced at the Leeds Forge?—Yes, for certain purposes. It only illumines the open side of the works, where the wind can blow through.

Dealing with the amalgamation of the Water-Gas Companies, witness said at the time of the joining of the Companies £1 per share was uncalled on the Syndicate shares, and £2 per share was uncalled on the Yorkshire and North British shares. By the amalgamation scheme, the two latter Companies were called upon to pay 10s. of the £2; and the

Syndicate were let off their £1. The Yorkshire Company were indebted to the parent Company to the extent of £15,000, and owed their bankers £7000; while the North British Company owed the parent Company a large sum, but had £12,000 cash in hand. The parent Company had nothing at the bank; but by the amalgamation, all the assets and liabilities were brought to the parent Company. The payment of the 10s. call was a condition to the amalgamation.

Witness's bank-books were produced in Court; and Sir F. Lockwood, after perusing them, asked if Mr. Fox could point to any account on which he could have drawn the cheques for £46,000 for the Royal College of Music, other than the account into which the subscriptions to the Leeds Forge Company were paid.

Witness replied that he could not enter into these figures.

Re-examined by Sir E. Clarke: He and his family, Mr. John Scott and his family, and Mr. Reid Stewart and his family were the principal persons interested in the old Leeds Forge Company. He, as Managing-Director, received from £400 to £1000 a year salary. From 1877, when he invented the corrugated flue, the Leeds Forge produced a great number of them; and during the existence of the old Company, and up till now, they manufactured ever-increasing quantities. The old Leeds Forge had the advantage of every one of his patents which were worked under his control. He received royalties from the Leeds Forge. In one year he got as much as £14,000; but in 1887, he capitalized his royalties, and took shares in the Company instead. He received 10,000 shares to purchase all the rights under the patents; so that when the new Company was formed, he had 11,000 shares in the old Company. The Company had enjoyed the whole benefit of the patents, together with the improvements in processes which were not known to other people. He invented and patented improvements which were necessary for the complete efficiency of the processes, and for giving them their full value; and the Leeds Company had the benefit of these improvements. The Leeds Forge Company had practically a monopoly in the work of turning out the corrugated flues. He sold the pressed steel bogey to the new Company for £96,000; and this sum was included in the £150,000 he got out of the new Company. Mr. Scott and his brother, Mr. Stewart, and himself were the principal shareholders in the new Company. They had never sold any shares, but had bought them. He held shares representing at par £140,000.

Sir E. Clarke: Has your attention been called at any time to any inaccuracy in the prospectus of the New Leeds Forge Company?

Witness: Never; and having seen the statements made in it, I say that everyone of them is true. The works of the New Leeds Forge are larger and more valuable than when the prospectus was issued. The statement that £10,000 a year was saved in fuel at the Leeds Forge was true; and the figure was obtained from works memoranda slips. Mr. Gordon and Mr. Lovering examined the books; and I did not interfere. I have no doubt that their certificates in the prospectus are correct. Mr. Craven formed his own judgment in making the valuation, without the suggestion of a single figure from me. Until Mr. Craven died in January last, I never heard any suggestion that his valuation was not a correct one. The interest on the debentures of the Leeds Forge has always been paid. There has been considerable depression in trade; but the volume of business is as great as ever, and there has been no year in which no profit has been made. The policy of the Company has been to expend the money which might have been paid in dividends in increasing the machinery and developing the undertaking. There was nothing in Cottam's conduct as regards the Leeds Forge which roused my disapproval. My experience at the Leeds Forge makes me believe that there is a great future for water gas. The persons in the employ of the Leeds Forge who put money into the undertaking had the very best opportunity of knowing about water gas; and they had the chance of selling their shares at a premium. I was Chairman of the British Water-Gas Syndicate; and when the prospectus was sent out, I firmly believed that the Company were going to acquire patents that would give them a monopoly. There were three authorities for the statement in the prospectus that water gas could be produced at a cost of 4d. per 1000 cubic feet; and these were Sir Douglas Fox's report, Sir Henry Roscoe's report, and the evidence of Mr. Kuppelweiser. I spent £40,000, in addition to paying nearly £40,000 for the patents, to bring the Company out; and that left me with a profit of £70,000, as a reward for my trouble in paying attention to the matter for some years. The rise in the British Water-Gas Syndicate's shares in 1889 made the public anxious to get water-gas shares; but there was nothing in the dealings of the Syndicate's shares to give them a fictitious value. The accidents at the Leeds Forge and at Hull, together with the minor explosions at Windsor, scared the public; and the enthusiasm ceased when the shares began to go down on the market. I first promised to give £30,000 to the Royal College of Music, in the early part of January, 1888; and at that time I owned valuable freehold properties. The shares in the old Leeds Forge which I held were worth £66,000, the Grove House Estate was valued at some £50,000 to £60,000, my interest in the Jolliet Steel Press Company represented £100,000, I was getting royalties amounting to £6000, and the pressed steel patents were afterwards bought for £96,000.

Was there ever a time during 1888 when you could not, at 24 hours' notice, have paid the money that you had promised to give?—No.

This concluded the evidence of Mr. Fox, who had been in the witness box for five days.

The representatives of two Yorkshire banking firms with whom Mr. Fox kept accounts were called, and gave evidence as to his financial position.

Mr. *John Scott*, C.B., M.Inst.C.E., stated that he was a member of the firm of Scott and Co., Shipbuilders and Engineers of Greenock—a firm which was started in 1710, and had never been out of his family. He became connected with the old Leeds Forge Company in 1874; and his connection with it had never ceased. In 1888, water gas was introduced at the works. The prospectus of the New Leeds Forge was issued after he had ascertained the truth of the statements it contained. Mr. Craven's valuation was an honest one. His present holding was 10,200 shares. The dividends which had been paid were paid out of the profits; and the business then fell off. It had, however, greatly improved during the last year or two. He was not a Director of the British Water-Gas Syndicate; but he held 2000 shares, though the shares went to a high premium he still held them. He was a Director of the North British Water-Gas Company; and he believed that the statements in the prospectus of this Company were true.

Wednesday, April 7.

On the resumption of the proceedings this morning,

Mr. *Scott* asked permission to correct the evidence given by him on the previous day with respect to the number of shares he had allotted to him in the British Water-Gas Syndicate. He applied for 2000 shares, and had 500 allotted to him.

In further examination by Mr. Boyd, witness said the earlier actions brought against the North British Water-Gas Company were based on the withdrawal of Mr. Donald Graham from the directorate; and the shares of those who desired to rescind amounted to about 5000. The parent Company bought them. Meetings were called in 1893 with a view to the amalgamation with the British Syndicate; and resolutions were passed by a majority of nearly 30,000 votes in favour of the amalgamation scheme.

In cross-examination by Sir F. Lockwood, witness said he did not know the price Mr. Fox was paying for the patents he sold to the parent Syndicate, and did not consider it was his duty, either as a Director of the North British Company, or as a member of the little Syndicate, to inquire. He was not aware of any expert having investigated the validity of the patents on behalf of the North British Company.

Sir F. Lockwood: Were you aware that there were actions commenced against Mr. Samson Fox and the North British Company, alleging fraud and misrepresentation?

Witness: I do not remember that fraud and misrepresentation were alleged; but I know the actions were brought.

Does it come to you as a piece of news that, at the time you were a Director of the North British Company, actions were brought against your Company and Mr. Fox, alleging fraud and misrepresentation?—I heard it in Court; but I did not know it before.

Re-examined: He had the highest opinion of water gas at the Leeds Forge. It effected an enormous saving, both in the rapidity of the production and in labour. The dividends paid by the Leeds Forge Company were all earned.

Sir *Henry Roscoe*, F.R.S., examined by Mr. Asquith, stated that in February, 1890, he was requested by the British Water-Gas Syndicate to make a scientific and chemical report on water gas. He accordingly visited the Leeds Forge, and inspected the water-gas plant in operation. He found water gas being applied to the welding of corrugated boiler flues—an operation requiring great heat—and used for the lighting of the works. Mr. Scudder assisted him, and spent a considerable time at the Leeds Forge under his direction. He visited the works on a subsequent occasion; and on the 14th of August he made his report to the Syndicate. It was based on his own observations and on those of Mr. Scudder. The results could be summed up as follows: (1) That water gas as manufactured at the Leeds Forge was a valuable agent for a variety of commercial purposes; (2) that it could be produced at a cost of from 4d. to 6d. per 1000 cubic feet, according to the fuel employed; (3) that it had a field open to it as an incandescent illuminant, and was purer, whiter, steadier, and cleaner than coal gas; and (4) the cost of labour was diminished, and but small outlay was required for plant.

Mr. Asquith: Did these conclusions represent the opinion to which you arrived as the result of your experiments?

Witness: They did; and I have never seen any reason to doubt their validity. They represent my opinion at the present moment.

It is alleged in the libels with which we are dealing in this case that "Sir Henry Roscoe, an equally high authority, was asked to report later on, and he put the cost of production at 50 per cent. higher; and his report, saving the signature, is the report of Scudder himself, the scientific adviser to the Syndicate." Is their any ground for the imputation that this report was merely a signature?—It is entirely unfounded. I visited the works myself twice. I was aware of the analytical and practical results arrived at by my assistant, in whom I place great confidence; and at that time Mr. Scudder was not employed by the Syndicate. As the price of the coke or other fuel varied, so would the cost of production vary; and I do not consider the difference between what I found to be the cost and that which Sir Douglas Fox found is large. My object was not so much to ascertain the maximum yield per ton of fuel, as to record the actual results of a continuous run of the plant at the Leeds Forge.

In 1891, did you visit the Continent for the purpose of inspecting the processes carried on in the manufacture of water gas?—I did. I was instructed by the Solicitors to the British Water-Gas Syndicate. I visited Messrs. Schultz, Gnant, and Co.'s works, at Essen, and those of the Hoerde Iron Company, Herr Pintsch, the Frankfort Gas Company, and the Frankfort Metal Company. In all the works I visited and inspected, I obtained information which satisfied me that the statements in the prospectus of the Notts and Derby Water-Gas Company, that water gas was used on the Continent with satisfactory results, were in substance correct. I also came to the conclusion that water gas was a commercial success, inasmuch as in several of the works visited considerable extension of plant had taken place since the introduction of the gas. With regard to the supposed danger to life of water gas, I have to remark that no fatal accident had occurred at any of the works on the Continent that I inspected from the time of starting to the time of my visit. I am satisfied that the method of odorizing is efficacious. At Schultz and Gnant's works, water gas was applied for welding corrugated and plain tubes as well as for lighting purposes. Some 900 lights were there, and there was also an engine driven by water gas. At the Mines and Iron Company at Hoerde, I had an interview with the Managing-Director, who informed me that the water gas plant was in operation before 1889, and that by the adoption of the gas the furnaces were worked more cheaply.

Sir F. Lockwood: Sir Henry Roscoe's report as to the result of his own experience we will accept as evidence. Sir Henry is reading a statement made to him as to the period in which the processes were being worked.

Mr. Asquith said they only wanted witness's observations.

In further examination, witness said he inspected the water-gas plant, which consisted of six generators, four of which were in operation, being employed to work two Siemens-Martin furnaces. They were fitted with the sliding valve and water-cooled ring, the patents for which were

acquired by Mr. Fox. This inspection convinced him of the feasibility of using water gas for the purposes of making steel.

Mr. Asquith: You came to the conclusion at Hoerde that it was useful for steel making?

Witness: Yes. The use of water gas at Hoerde was an unqualified success. At Pintsch's, they were erecting plant for using water gas for lighting. I saw the plant there for welding large steel boilers, for welding and brazing gas-cylinders for railway carriages, for illuminating purposes, for driving gas-engines, and for blowing glass in the manufacture of electric lamps. I came to the conclusion that, in regard to all of these processes, water gas was a useful agent. At the Frankfort Gas-Works, I found a plant erected which was used to light the station; and the result was satisfactory both from what I saw and heard. I also visited the reduction-works of the Frankfort Gold and Silver Reducing Company; and water gas was used successfully there.

Have you, as a practical as well as a theoretical chemist, followed the commercial application of water gas down to the present day?—Yes, in a general way.

In particular, have you studied its application to lighting purposes?—Yes; water gas has since been very largely used in assisting coal gas production. One of the great advantages of water gas is the rapidity with which it can be produced; and a very large number of the gas-works in this country and elsewhere have set up water-gas plant for the purpose of assisting in the manufacture of coal gas when a demand arises—on a foggy day, for example. They are then able to send out a considerable quantity of carburetted water gas. The Beckton Gas-Works have such a plant.

At the time these Companies were formed, was carburetted water gas made?—No; at any rate, it was not so well known as it is now.

Is there any foundation for the suggestion that water gas could be fairly described as a bubble or bogus invention?—No; I consider it a very valuable commercial thing.

Mr. Bigham (in cross-examination): Though these Companies had in their hands the possibilities of millions, they failed to realize them?

Witness: Yes: but this was not from any inherent failure in the processes themselves.

Water gas was known a long time before Mr. Fox was heard of?—We knew that if water vapour was passed over red-hot coke or carbon it was decomposed, and produced a gas.

Has water gas been produced without reference to any patents at all?—I cannot give an answer to that question.

Is the Fahnehjelm comb a device by means of which the gas can be brightened in its illuminating power?—The Fahnehjelm comb consists of thin cylinders of an infusable material, and when the gas impinges upon it, it is heated up to a very high temperature, and gives off light. The gas is not rendered luminant. It is on the same principle as the Welsbach mantle. I do not know the date of the Welsbach patents. Pure water gas without the Fahnehjelm comb is useless as an illuminating agent.

What is the illuminating power of water gas with the Fahnehjelm comb as compared with coal gas? Am I right in saying that pure water gas is nothing like so good an illuminant as coal gas?—Taking the volume of gas burnt, the amount of light thrown out by water gas with the Fahnehjelm comb is greater than with coal gas; but I have not made measurements. The carburetted water-gas system has been used in recent years.

Carburetting, as I understand, consists in mixing with the pure water gas about 40 per cent. of gas obtained from vaporized petroleum, which itself supplies a very bright illuminant. At present, so far as water gas is employed for illuminating purposes, is it used in the carburetted condition?—The object of carburetting is to render water gas luminous. Whether or not it has superseded the Fahnehjelm comb I do not know; but in so far as it is carburetted, and is used in that condition, it has superseded it because it burns then from the ordinary burner. Gas companies who employ water gas use it in its carburetted condition because it does not require the comb.

In further cross-examination, witness said it was a fact that in recent years a large quantity of machinery for the purpose of producing carburetted water gas had been turned out in this country. He had no reason to suppose that the cost of distributing water gas was greater than that of distributing coal gas. The greater bulk required depended upon the quantity of carburation; but he really did not know the cost of these things.

Mr. Bigham: To obtain the same result, would you not require a great deal more bulk with water gas than with coal gas?

Witness: No; a cubic foot of water gas is equal to a cubic foot of coal gas.

Do you say the heating power of water gas is less than that of 16-candle power coal gas?—It depends upon what you call heating power. The total amount of heat given out is less; but the temperature of the flame of water gas is higher.

In further cross-examination, witness said he was instructed by the Solicitors of the British Water-Gas Syndicate to visit Germany in 1891 to report as to whether or not water-gas plant was satisfactorily at work there, and what degree of importance the persons using it attached to it. When the Solicitors came to him, he might presume they wanted scientific evidence in connection with some litigation; but he did not know it was for the purposes of litigation. He had only heard of the charges of fraud since he had been in Court.

Re-examined by Mr. Asquith: When he visited the various works in Germany, he carefully inspected all the processes, and satisfied himself of the truth of the statements made in his report. He was now aware that these statements were strictly and literally correct. It was a known chemical fact, long before the prospectuses were issued, that the action of carbon would produce light. The use of an infusible metal like magnesium would give out light. Until he saw the Leeds Forge, he had never seen water gas applied to illuminating or welding; he had never before seen it at work producing commercial results. He had not gone into the question of the patents themselves. When he saw water gas at work at the Forge, it was acting satisfactorily as regarded both illuminating and welding. It was not carburetted, but was acting on magnesium combs. The gas he saw in Germany used for illuminating was not carburetted, but was acting on Fahnehjelm combs.

Professor *Vivian B. Lewes*, F.I.C., F.C.S., was the next witness. In answer to Mr. Colefax, he said he had been actively engaged in the question of the production and utilization of gas for eighteen years. Water gas was susceptible of taking two forms—pure and carburetted. The basis of all water gas was the mixture of carbon monoxide and hydrogen produced when water was decomposed by glowing coke. The gas could then be carburetted. He had seen pure water gas used at the Leeds Forge for steel making and for welding, as well as for the production of light by Fahnehjelm combs. For these purposes, it was undoubtedly successful. For steel smelting, it was mixed with producer gas. Water gas gave a very intense heat, while producer gas contained about 30 per cent. of combustible and 70 per cent. of non-combustible matter, and was accordingly of low heating value. In making and smelting steel, certain ingredients had to be melted together; and for producing a good steel it was necessary that the temperature should be kept constant for a considerable period of the operation, and then raised quickly towards the close—that time being found to be the most economical and efficient in manufacture. By mixing together water gas and producer gas, they could keep the temperature constant to a certain point; and then, by reducing the quantity of producer gas, they could get the final excess of heat necessary for turning out good steel. He had seen water gas used for illuminating purposes at Essen. It was Sunday when he was there, and no machinery was working; but he could see that there was plant for welding with water gas. His knowledge as to the time when the Leeds Forge plant was erected was taken from the "Journal of Gas Lighting;" and he thought it was early in 1888. Before March, 1888, water gas was not used commercially in England; and Mr. Samson Fox undoubtedly introduced it into England. The luminosity of a water-gas flame with a Fahnehjelm comb was considerably more than ordinary London coal gas. If the same burner were used, water gas with a Fahnehjelm comb would give 4¼ candles for each cubic foot consumed, while coal gas would give a little less than 2 candles.

Mr. Colefax: How, in 1889, could water gas be used as an illuminant?

Witness: By means of incandescent lighting. Attempts were made at the time to introduce carburetted water gas into England; but, owing to the price of oil, they failed. Incandescent lighting was the method of using water gas which could best develop its light-giving properties.

Since 1889, has carburetted water gas come largely into use in England? Enormously, both for enriching and for increasing the volume of coal gas. I have glanced through the patents acquired by the British Water-Gas Syndicate.

Baron Pollock: Are they all patents for processes to manufacture the commercial article, or are any of them for the actual invention of the article?

Witness: As far as the water gas is concerned, they are none of them patents for the invention of the article, but merely for processes.

Mr. Colefax: At the date of the earliest of these patents, was it possible to obtain a patent for the simple invention of the production of water gas?

Witness: Certainly not; it was a hundred years old.

In further examination, witness said that in the generator at the Leeds Forge, they had two, if not three, patents applied. There were two patents for the water-cooled slide-valve, and one for the water-cooled ring. The slide-valve at Leeds was provided with grooved ports which prevented any short-circuiting when the valve was open or shut, and allowed the escape of any explosive mixture. The five other patents acquired related to the production of carburetted water gas—one especially being the forerunner of the present carburetted water-gas process. The patent of Lowe and Dwight (No. 173 of 1878) was for carburetted water gas; and this was the base patent for the production of that system of water gas.

At the invitation of the Court, witness here gave a description of the process of manufacture as shown by a large diagram exhibited. He said in making water gas by this process there were two distinct stages. First of all, the coke in the generator had to be brought up to an incandescent temperature by blowing through it an air-blast. When the whole mass was heated to incandescence, the air-blast was cut off, and steam was injected through the incandescent fuel. The steam was decomposed into water gas—the gas which was made while the coke was being blown up to the right temperature being producer gas. In such an apparatus, they must either have fire-bars or a constriction in the vessel, in order to leave a space near the bottom of the fuel through which the air-blast could be regularly sent in. If they had no fire-bars, they must have a projection near the bottom, which would leave a circular space through which the air could go, and filter up through the mass of coke. If this projection was made of fire-brick, they would get such an intensity of heat through the strangulation that the brick would become fused upon its surface, and the slack as it came down would act upon the projection and melt it away. The water-cooled ring was so placed that it made the projection, and the iron would be burnt through immediately but for the water-jacket round it. The device really gave them a projection without the destruction of the particular part of the generator. The benefit of the water-cooled slide-valve was this. The steam went down through the fuel, and had to escape through a valve which must of necessity be close up to the generator. Consequently, water gas as it escaped at that point was of very nearly the same temperature as the fuel in the generator—so high, in fact, that if an ordinary metal valve were used, it would become so rapidly warped as not to be usable in a very short time. In order to keep the faces of the valve in proper condition, the two portions were jacketed with water, and one slid upon the other. The patent for the water-cooled slide-valve with the grooved ports was useful, for the reason that when the water-gas exit was open it would lead to explosions if there were any chance of the air getting over into the gas-pipe, or the gas getting over into the air-pipe. To prevent this, two grooves were made in the face of the valve, so that the water gas leaking from one valve to the other would go into the open air.

Mr. Colefax: Having seen the generator at work, would you say it was successful for the production of simple and pure water gas?

Witness: I should say it was a thoroughly successful generator.

Sir Henry Roscoe says water gas can be produced at from 4d. to 6d. per 1000 cubic feet. How much water gas can be produced from a ton of coke?—The average production would be 34,000 cubic feet. Sir Henry Roscoe put it at 23,000, and Sir Douglas Fox at 36,000 cubic feet. Witness went on to say that the whole economy in water-gas production

depended on the ratio of the blow with the make. The period of blow was when air was blown up to make the fuel incandescent; and the period of make was while the steam was passed down the incandescent fuel to make water gas. Producer gas was made during the blow, and was of little value; while the water gas was the all-valuable product. In Sir Henry Roscoe's report, there were evidently local circumstances which necessitated the blowing being carried on for a longer period than in the case of Sir Douglas Fox's experiments. In the report, there were 6000 cubic feet of producer gas to 1000 cubic feet of water gas; while in Sir Douglas Fox's experiments the proportions were 3800 to 1000. This would account for the difference in cost and in the quantity produced per ton of coke.

Are you aware of the cost of production of water gas at the present time?—You can get the figures from the general practice of carburetted water-gas making; and they will work out at 4d. per 1000 cubic feet, if the cost of the fuel is 6s. 8d.

Would the patents which the British Company acquired equip them for commercially dealing with the production of carburetted water gas?—The patents covered the generator, which was the first one that had been commercially and successfully used.

Cross-examined by Sir F. Lockwood, witness said his attention was first called to the system of production of water gas under Mr. Fox's patents in 1889, by being questioned about it in his capacity of Gas Examiner at the time of the flotation of the Companies. Up to 1893, he had not seen any of the patents in operation. He was perfectly familiar, though he had not seen Fox's patents in operation, with the fact that when steam was passed through incandescent carbon a mixture of carbon monoxide and hydrogen was got off, which burned with an intensely hot flame. He had not seen before 1893 a system for producing pure water gas; but he had considerable experience in producing the carburetted water gas in which the production of water gas was a preliminary stage. He made a number of experiments at Humphrey's Hall, Knightsbridge, upon an installation put up by Van Steenbergh; but that was a failure, as all other installations of carburetted water gas were at that time. He perfectly well knew the progress that had been made in water gas in America. He did not think he had, in October, 1889, expressed the opinion that the adoption of water gas in America was not a commercial success; nor did he publish a paper in the "Journal of Gas Lighting." He should very much doubt having published such a statement, as he held a contrary opinion at the time. He should say they had in Mr. Fox's patents the patent which practically governed the system of Messrs. Humphreys and Glasgow. In the Lowe and Dwight patent, they had the fundamental principles underlying that system. There were many patents which related to alternatives for the water-cooled ring and slide-valve. He had only seen water gas used on the Continent as an illuminant.

In re-examination, witness said the water-cooled ring would last longest, and was therefore the most economical in working.

By permission of his Lordship, Professor Lewes than showed a practical working experiment of water gas as an illuminant. He took a No. 3 Bray burner with a Fahnehjelm comb, and lighted it; water gas being supplied from a cylinder which had been filled at the Leeds Forge. When first turned on, there was a non-luminous flame; but as it impinged on the comb, it grew in incandescence and produced a strong white light. Professor Lewes stated that in 1889, when it was brought out, it was an enormous stride forward on any illuminant that had been introduced before. It created at the time a very considerable alteration. If ordinary coal gas was burned with this burner, they would not get 2 candles per cubic foot of gas consumed; but with water gas, they obtained 4·6 candles.

In answer to his Lordship, witness said that was the form in which he had seen it used. The first combs he had anything to do with lasted 100 hours; but some of them would last 400 hours. The combs cost about 1s. 6d. per dozen. The Welsbach mantles were then in existence; but they were extremely poor. Then came the great discovery of the effect which thoria with ceria made in the manufacture of the mantles; and they were now infinitely superior to those made at first. The Incandescent Company was practically a failure in 1893.

Thursday, April 8.

On the resumption of the hearing this morning,

Sir F. Lockwood said he understood that Professor Lewes was not present; but his Lordship might remember that, in the course of his cross-examination, he put to him an extract from a paper, and asked him whether he did not express a certain view in 1889. He asked, in justification of his question, that he might be allowed to read an extract from a work by Professor Lewes entitled "Service Chemistry."

Mr. Boyd said he would have Professor Lewes in Court again. He could not be there that day owing to a professional engagement.

Mr. *F. G. Worth* was then called. He stated that from 1891 till the winding up, he was Managing-Director of the British Water-Gas Syndicate; and from the date of the amalgamation till 1895 he acted in a similar capacity with the amalgamated Company. He afterwards became a Director. His salary as Managing-Director was £800 a year. He believed water gas to be an absolute success at the Leeds Forge. When he became connected with the Water-Gas Company, he found there had been a great deal of disorganization among the staff; and he undertook to group the men to work together in the interest of the shareholders, to show whether or not water gas could be proved a commercial success at the places where the plant was in course of erection. The only plants which had been erected while he was Managing-Director was at Messrs. Clough Bros. and at Stewart and Clydesdale's tube works; and both of these were successful. He came to the conclusion, in the summer or autumn of 1892, that amalgamation would be in the interest of all the shareholders; and he drew up the statement that was the basis of the amalgamation. He did not do so in any private individual's interest. The British Board fully and fairly discussed the matter, and so did the North British Board. The amalgamation scheme was adopted by very large majorities at the meetings of the British, North British, and Yorkshire Companies.

Cross-examined by Sir F. Lockwood: Some vendors' shares in the British Syndicate were transferred to him by Mr. Fox, in order to give him his Director's qualification. The North British Company and the Yorkshire Company did not acquire any works. The British Company, however, took over the Uddingston works; but they were never paid for. The scheme of amalgamation provided for a working capital of £15,000; but only £4000 or £5000 came in, and the Company never really had any working capital because of litigation.

Sir F. Lockwood: How long is it since the Company had any cash?

Witness: I cannot say. I had a few shares in the North British Company; but I only paid Mr. Fox a trifling sum for them. They enabled me to attend the meetings.

Re-examined: There was no foundation for the suggestion that the money of the amalgamated Companies had been misappropriated.

Sir *Douglas Fox*, Vice-President of the Institution of Civil Engineers, and a member of the Institution of Mechanical Engineers, examined by Sir E. Clarke, said he was no relation of the plaintiff; and he had never had anything to do with the Water-Gas Companies, except in making his report. Early in 1889, on account of a South American Railway Company, to which he was consulting engineer, he made some inquiries in reference to water gas; and he thus became acquainted with the Leeds Forge. He was asked by Mr. Cottam to make a report; and he sent Mr. Hobson, his assistant, to the works, with Mr. Watson, his inspector, and Mr. Stead, a chemist. These gentlemen made three trials; one of four hours, and two of two hours each. They gave him details of the plant and results; and he had the drawings before him prior to making his report on March 28, 1889. Before supplying the report, he gave the covering-letter which appeared in the prospectus. With reference to the estimate of the cost of production being put down at 4d. per 1000 cubic feet, he explained that the details he received brought the cost out to about 3¾d. But after going through the figures, he was satisfied that the amount that was put down for interest and depreciation was not sufficient; and he considerably added to it, and put the cost down at "less than 4d." His correct figure was 3·64d. per 1000 cubic feet. The cost of water gas must depend upon the use which could be made of producer gas. In the case of supplying a private house, they could not use producer gas; but at the Leeds Forge, it assisted in firing the boilers.

Sir E. Clarke: Suppose you assume that producer gas is to be struck out, will the cost still be under 4d. per 1000 cubic feet?

Witness: Yes.

There is a suggestion in the libels that you had been hoodwinked. Were the gentlemen who made the observations for you, gentlemen whom you had known for years?—Yes. Mr. Hobson, my then assistant, has been with me for fifteen years; and he is a member of the Institution of Civil Engineers, and a man of great experience. Mr. Watson, who took the actual measurements, has been with me for ten years. I consider the suggestion is an improper one to make of a professional man.

Did you accept any statement in regard to this matter except from these two gentlemen?—Certainly not. I had no communication with anybody connected with this matter until I sent in my report.

The report says: "The plant is simple in construction, and requires no skilled labour in working." And: "The water gas is used for welding and lighting; and twenty stoves have been erected in the offices for heating purposes."—It is a thoroughly good mechanical arrangement; and an economical form of generator. The whole question of valves is of great value in connection with water gas, because of its explosive nature. The plant is constructed with a view of giving safety.

Have you anything to withdraw or qualify in the report?—No; I am thoroughly prepared to stand by it.

Sir F. Lockwood, in cross-examination: The appendices are made up from returns which were sent to you by gentlemen whom you entrusted to make experiments?

Witness: Yes.

You have confidence in them?—Absolute confidence.

The cost you arrived at—3·64d. per 1000 cubic feet—which justified you in giving the covering-letter or certificate, depends upon the time of the run, the amount and cost of fuel consumed, and the nature of the charge?—Yes.

All these data had been supplied to you by others?—By Mr. Watson. I was not present at the experiments.

Were you familiar with water-gas generators before you made this report?—No; I heard that water gas was being used in America.

And practically what you have done is this: You have taken certain figures which have been supplied to you, and you have checked and altered the calculations?—Yes, by increasing the figures.

Some discussion took place after the luncheon interval as to the probable length of the hearing; and it was ultimately agreed that the Court should not sit on Saturday, and should adjourn over the Easter Vacation on the conclusion of the case for the plaintiff.

Mr. *John Imray*, M.Inst.C.E., M.Inst.M.E., stated that he had been a Consulting Engineer and Patent Agent for thirty years. The patents relied on as anticipating Lake's patent of 1884, in his opinion did not anticipate it. Lake provided a practically indestructible narrow neck for the furnace of a water-gas generator; and this was a useful invention.

In cross-examination, witness said he did not think that Brook's patent of 1883 anticipated Lake's. Nowrocki's patent of 1884 was not published until after Lake's; but if one had a licence, one could manufacture under either. Cooling rings for furnaces had been known to him for thirty years.

Re-examined: In the case of a water-gas furnace, the ring outside the brickwork would be of no use, owing to the intensity of the heat.

Mr. *Frank Scudder*, technical chemist, stated that on Sept. 23, 1890, he was appointed scientific adviser to the British Water-Gas Syndicate—after the date he had worked for Sir Henry Roscoe. When Sir Henry Roscoe's report was made, he was not connected with the Syndicate. In 1890, he visited America; and he there saw water gas used for lighting purposes. He went to New York, Chicago, Philadelphia, Jackson City, and Brooklyn. The Fahnehjelm comb was employed at Hyde Park, Chicago, and at Jackson City. At the latter place, 20,000 people used it. Electric light and coal gas competed with the water gas. It was also used for metallurgical work at the great saw manufactory of Disten's, at Tacony, near Philadelphia.

Sir F. Lockwood did not quite follow to what issue this evidence could be used.

Sir E. Clarke contended that the questions were material, because the libels referred to the amalgamation.

Sir F. Lockwood asked witness if he was speaking of pure water gas.

Witness replied that he was. He added that in Chicago, Jackson

City, and Philadelphia it was pure water gas. He saw carburetted water gas produced under the Lowe process—that was described in one of the patents acquired by the Company.

In further examination, witness then described his visit to Germany in 1891, with Sir Henry Roscoe, and agreed with that eminent authority as to the successful use of water gas in that country. He further stated that he had seen the gas used at the Leeds Forge for welding, lighting, for the Siemens-Martins furnaces, and for cooking; at the Lancaster Wagon Works for welding; and at Messrs. Moss Bros. for singeing. At all of these places it was useful. He was familiar with the construction of the generator; and he agreed with Professor Lewes's evidence on this point. It was a good piece of machinery. It embodied certain patents acquired by the Company; and he knew no other generator which would do the work that this one did. In 1889, the cost of oil in the United Kingdom did not allow the production of carburetted water gas, which was now being produced in considerable quantities to enrich coal gas. It was not being employed as a separate illuminant in any place.

Cross-examined: Petroleum in 1889 cost 5d. a gallon; now it could be bought for 3½d. He went to the Leeds Forge twelve or fifteen times for the purposes of Sir Henry Roscoe's report. He was supplied with the figures for the cost of the fuel; but he took a note of the volume of gas made, and saw the furnaces charged. He had been scientific adviser at the Normanton Chemical Works before he was connected with the Leeds Forge. At the Tacony saw manufactory, the Loomis plant was used. He did not know they abandoned water gas there in 1893. Water gas was never used alone in England for metallurgical purposes. For lighting, the carburetted system had practically superseded the Fahnehjelm comb. His visit to Germany was to collect evidence in the Notts and Derby case. At Messrs. Moss Bros., the cost of production of water gas might be 10d. to 1s. per 1000 cubic feet; but it would depend on the price of the fuel. He put the plant at the Lancaster Wagon Works in order; and it was a success. He satisfied their expert.

Friday, April 9.

Mr. *John Graham Stewart*, a partner and joint Managing-Director of the Stewart and Clydesdale Company, Limited, of Glasgow, was called this morning. He said his firm manufactured iron and steel plates and tubes. In 1893, his attention was called to water gas; and he saw experiments with it for welding tubes at the Leeds Forge. He afterwards saw it at Essen and at the Lancaster Wagon-Works; and he ordered plant to be put up at his own works. He also saw experimental plant erected at the works of the Glasgow Iron Company. His firm used water gas for welding plain tubes; and for this purpose, as well as for riveting, it was a success.

In cross-examination, witness said the Glasgow Iron Company did not weld tubes; and the experiment he saw was conducted by the North British Water-Gas Company. Mr. Reid Stewart, a Director of the Company, was connected with the Glasgow Iron-Works, but was no relation of his. At Stewart and Clydesdale's, they had no meters to measure the water gas consumed; but they knew the cost by the fuel burnt. He could not say what quantity of coal gas would be required to perform the work done by the water gas.

Mr. *J. Spencer*, Managing-Director of John Spencer and Sons, Limited, of Newburn-on-Tyne, gave evidence as to the erection of experimental plant at his Company's works by the North British Water-Gas Company. He stated that the arrangement was that the North British Company were to put up the plant and submit the results to him, and that the cost should be borne by the North British Company unless the plant should be taken over. The furnaces at Newburn were of the usual regenerator kind, but were exceptionally long. At the Leeds Forge they were much smaller. Water gas could not be applied to a long furnace, as the flame was short; but, as far as his experience went, he should think it would be useful in a smaller furnace.

Cross-examined: As far as his firm were concerned, the installation at their works was quite an experiment; and they did not pay a single sixpence in connection with it. The plant was still at Newburn, but it was not used. His firm were not to pay anything until a certificate had been given that a saving was effected in labour and cost by the water-gas process; but no certificate had been given to him. He did not know how much money had been thrown away by the Syndicate in connection with the experiment. The experiment was a failure for the long 30-ton furnace. A furnace ought to stand 400 charges; but he was not aware that the wall 14 inches thick was reduced to 5 inches after 33 charges.

Mr. *John Gordon*, Chartered Accountant and Deputy Mayor of Leeds, stated that he was the Auditor of the New Leeds Forge Company and of the Amalgamated Water-Gas Companies. Questioned as to the difference in figures of £285,000 in the last balance-sheet of the old Leeds Forge Company, and the £564,000 in the valuation of Mr. Craven, witness said there was not included in the first-named sum the £96,000 for the pressed steel frame patents; and there was nothing put down for goodwill. Three years' profits was a usual figure for goodwill; and in 1887 the profits were £45,000. Mr. Craven valued the patents as a monopoly, and therefore would not include goodwill in his valuation. The New Leeds Forge Company in their eight years' existence had made a profit of £268,378, of which £129,582 had been spent on additional plant, and £105,000 written off for depreciation. The average yearly profit of the new Company was £30,782; last year's profit was £39,543. Every year there had been a profit. The turnover for the eight years was £1,456,000; making an annual average of £182,000. In 1896, the turnover was £221,000. In the last two years of the old Company, the profits were £45,000 and £69,000; while in the first two years of the new Company, they were £77,000 and £52,500.

Mr. Boyd: It is suggested in the libels that a special balance-sheet was got out for the purpose of forming the new Company?

Witness: There is no truth in that. In 1895, I was requested to get out figures to show what had been the saving at the Leeds Forge in connection with the introduction of water gas, in view of showing that the statement in the prospectus of the New Leeds Forge Company that £10,000 a year was so saved, was a correct one. I got the figures from the books; and found the saving was nearly £10,000.

In further examination, witness gave figures to show that Mr. Fox lost by the amalgamation of the Water-Gas Companies.

Mr. Bigham cross-examined Mr. Gordon as to why Hardcastle, the Auditor of the old Leeds Forge Company, should have had his services dispensed with at the time the new Company was being formed; but witness, beyond saying that Hardcastle and Cottam had quarrelled, could give no reason. He unhesitatingly said that the assets stated at £285,000 in the 1887 balance-sheet of the old Leeds Forge Company were not put at their true value. It was very likely that, to pay the dividend of 10 per cent. in 1887, the bankers of the old Company had to grant an overdraft. The ordinary, preference, and debenture holders in the new Company had received £150,000 in dividends.

Mr. Bigham: Does the reserve consist of two items written off depreciation?

Witness: Yes; they are the same in character.

Is it an asset?—If you do not write it off it is an asset.

Mr. Bigham: If you had a three-legged stool, then, and it lost a leg, that leg becomes an asset.

Witness added that, by the agreement under which Fox sold his pressed steel frame patents, he "did not guarantee" their validity. Under the agreement, he got one-third cash and the balance in preference shares.

Re-examined: He never heard that the patents had been challenged.

Mr. *Ralph Pollard*, formerly hammerman at the Leeds Forge, gave evidence that as to his taking shares in the Water-Gas Syndicate for the cash and bonus he was to have from the little Syndicate. He acted, in doing so, on his own judgment, and was not advised by Mr. Fox.

Cross-examined: He did not know, when he offered to take shares in lieu of cash, that he was to receive vendor's shares which could not be sold.

Sir F. Lockwood: If you had known that you could not have realized them, would you have signed the application?

Witness: Well, I hardly think I should. I only got one dividend.

The further hearing of the case was adjourned till Monday (yesterday).

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Saturday, March 27.

(*Before Mr. Justice* Lawrance.)

South Staffordshire Water-Works Company v. Barrow.

This was an action brought by the plaintiffs to recover from the defendant a small sum in respect of water-rate; the point in dispute being the basis upon which the rate should have been charged.

Sir R. T. Reid and Mr. A. T. Lawrence appeared for the plaintiffs; Mr. Duke represented the defendant.

Sir R. T. Reid, in opening the case, remarked that, though the plaintiffs claimed only a small sum, a very serious question was involved—viz., whether the water-rate was to be charged upon the gross estimated rental or upon the net rateable value of the defendant's house, depending upon the construction of certain Acts of Parliament. This rate had been raised for thirty years on the gross estimated rental, which he contended was the right principle; but, of course, this did not prevent it from being quite wrong. There were no facts in dispute; and therefore there was no evidence. Certain admissions had been made; and at the end of the pleadings, the issue to be tried was stated—viz., that the sole question to be raised for the opinion or discussion of the Court should be whether the plaintiffs were, by virtue of the South Staffordshire Water-Works Act, 1866, and the Company's other Special Acts, incorporating the Water-Works Clauses Act, entitled to charge the defendant the water-rates as claimed on the annual rack-rent or value under the scale prescribed by section 35 of the Burton-on-Trent Water-Works Act, 1861, or whether they were bound to charge them on the net rateable value under the scale prescribed by section 34 of the South Staffordshire Water-Works Acts, 1853. If the decision were favourable to the defendant, it would inflict disastrous consequences on the plaintiffs, as they would have to lower their assessments by a very large sum. The first Act in question was the Company's Act of 1853, section 4 of which described the limits of the Act; and it was sufficient to say that the house in question was not within those limits. The important section was 34, which specified that where the annual value of a house did not exceed £10, the charge should be at a certain rate per cent. per annum; where it did not exceed £7 10s. at another rate; and so on, with varying charges according to the annual value. It was agreed that the "annual value," according to the construction placed on the words by the House of Lords in the Dobbs case, must be taken to be the net rateable value. The next Act was that of 1861, by which the Burton-on-Trent Water Company was incorporated. Section 4 of that Act prescribed the limits, including the town of Burton; but the house now in question was not within those limits. Section 33 of the Act, which specified the charges, set forth that, where the "annual rack-rent or value" of the premises did not exceed £5 per annum, then the charge should be at a certain rate, and so on; varying according to the value of the premises. Here again it might be taken that in this clause "annual rack-rent" meant the gross estimated rental.

Mr. Duke said he agreed that the words probably meant the gross estimated rental; but there was a question on the succeeding words—"or value"—as to what would be the measure of the charge there, and whether the Water-Works Clauses Act came in.

Sir R. T. Reid said so far the matter stood thus: In the South Staffordshire Act, the rates were to be taken on the net rateable value; and in the Burton-on-Trent Act, on the gross estimated value. The 48th and following sections of the Act gave power for the Burton Company to enter into agreements for the lease or sale of their undertaking to the South Staffordshire Company; and in 1866 an Act was passed under which an amalgamation of the two Companies took place. Power was given to construct additional works, and so on; and by section 24, it was provided that the limits defined in the Act of 1853, of the Burton-on-Trent Act of 1861, and of the Act of 1866, should comprise and include the various parishes and townships specified. Among these was a place called Winshill, within which the house now in question was situate, but which had not been within the limits of either of the former Acts. Several other places were also brought in, to which it was not necessary to refer. Then the Act went on to provide that it should be lawful for the Company to exercise within their extended limits the same powers as the recited Acts would entitle them to exercise therein had such parishes

and places been originally included within the area defined in the Acts. His contention was that this gave the South Staffordshire Water Company the right to exercise the powers conferred by either of the previous Acts, and therefore, within the Burton-on-Trent district, as well as the additional districts brought in by the Act of 1866, to charge on the gross estimated rental. This case had been before the Judge of the County Court, who dismissed the plaintiff's claim on a technical point, which did not now arise—viz., that some notice or other had not been given to fix the value. But, being invited to give an opinion on the real question in dispute, he gave it adversely to the plaintiff's contention, which seemed to be based on something contained in section 30 of the Act of 1866. This section set forth that the undertaking of the Burton-on-Trent Company, purchased by the South Staffordshire Company under the powers of the Act of 1861, was by that Act united with the other undertaking; and that the property, assets, &c., belonging or attaching to the Burton undertaking became vested in the South Staffordshire Company as effectually as if the Company had been specifically named, and as if the undertaking of the Burton Company had been part of that of the South Staffordshire Company, and as if the limits of the Act of 1853 had comprised those of the Burton Act of 1861. The learned Counsel then read a portion of the decision of the County Court Judge, by which it appeared that his Honour was of opinion that the Act of 1853 was really meant to govern the whole amalgamated district, and that the rates therein specified were to be those in force. He (Sir R. T. Reid) contended, however, that the purpose of this section was simply to vest the property in the Company, and had no reference to the charges to be imposed. He might add that Winshill was really now within the limits of Burton-on-Trent; and therefore it would be very strange if the Burton Act should apply to other parts of the borough, but not to that place.

Mr. Duke said his friend's argument came to this—that the Company had succeeded in inducing the Legislature to give them two inconsistent scales of charges, and that they could take their choice, and impose on the public the most disadvantageous one. This, he might remark, was not exactly what one would expect in an Act of Parliament.

Sir R. T. Reid said there was no doubt that, until the Dobbs case was decided in the House of Lords, everyone was of opinion that the two expressions "estimated annual value" and "annual rack-rent or value" were equivalent.

Mr. Duke said he was inclined to think that it might now be argued that they were equivalent, and that they meant net value; but it was not necessary to rest his case on this point, as it was a very large question, and many authorities would have to be considered. He proposed to limit himself to the one matter. If the Legislature had done this, it was a very remarkable thing; but if it considered that it was using two expressions that were to be equivalent, his first point was that they were to be construed in favour of the consumers, and not of the promoters of a private Company. It was a very old principle, in the interpretation of Private Acts of Parliament, that any uncertainty was to be construed against the person who applied to Parliament for exceptional powers. In 1853, the South Staffordshire Company agreed to supply their district at certain rates charged on the annual value of the premises. In 1861, an undertaking was formed to supply the town of Burton-on-Trent at rates which, as his friend said, were understood to be on the same basis; and at the same time the Company took power to sell their undertaking to the South Staffordshire Company. In 1866, an Act was passed which consolidated the districts of the two Companies, and set forth that the smaller should be absorbed in the larger, and that the enlarged Company should extend their limits over the new district, including Winshill. Nobody at the time thought there were any discrepancies in the rates given in the two Acts; but it was now argued that, though "annual value" did not mean "gross value," as authority was given in the Burton Act to charge on the gross value, and as the South Staffordshire Company had taken over the powers of the Burton Act, they could charge on the gross value, not only in the town, but in the whole district. This was a curious mode of laying a new tax on the water consumers in the whole of Staffordshire, and in parts of Warwick and Worcester.

Sir R. T. Reid said it was admitted that, under the Act of 1853, they were bound to charge on the net rateable value, and within the limits of the 1861 Act on the gross value.

Mr. Duke said he did not admit it; but it was no affair of his. He simply had to deal with the intermediate area created by the Act of 1866. His friend said the result was that in this new area there was power to the Company to charge either one rate or the other. Before going into the argument, he wished just to point out that his client did not come to the Court of his own choice, and that he ought to have been sued in the County Court; and he wished at the outset to make a strong protest at having been brought to fight this matter, for the good of the Company, in a Superior Court. The first question was: Was there a real inconsistency in the rating clauses of the two Acts. The water-rate was to be a certain charge per cent., increasing; but neither of the Acts specified on what basis the rate was to be calculated. If there were no Act which governed these sections, then the wording would have to be enlarged so as to apply the percentage to the subject-matter mentioned in the sections. But this was contrary to the proper principle in dealing with these matters with respect to the powers of water companies; and his first contention was that, in order to ascertain on what the percentage was to be assessed, they must look at the Water-Works Clauses Act, 1847, which was incorporated in both the Acts in question. Section 68 of the General Act set forth that the water-rates should be "payable according to the annual value of the tenement supplied with water." Now, it was common ground after the Dobbs case that "annual value" meant "net annual value;" and as section 68 of the General Act had to be incorporated with both section 34 of the Act of 1853 and section 35 of the Act of 1861, the latter section, on which his friend relied, ought, when read in conjunction with the incorporated section—the explanatory section in the Water-Works Clauses Act—to read thus: "Where such annual rack-rent or value shall be above £20 per annum, the rate per cent. per annum not exceeding £5 according to the annual value of the tenement supplied with water." There was this express provision in the Water-Works Clauses Act, which specified what was the subject-matter to which the percentage should apply; and when this was read into the sections of the Special Acts, the apparent inconsistency disappeared. It was obvious that the Legislature considered there was only one scale of rating, and no discrepant power which needed to be reconciled. He submitted that the alleged inconsistency did not exist when the provisions of the Water-Works Clauses Act were applied. His second point was that these sections gave a power to the water consumers, and not to the Company. The Company were bound, on the application of any person who came under the provisions of the Act, to furnish him with a supply of water at the specified rates; and if there were two different rates authorized (and this, as he had already submitted, he did not admit), then the option was with the consumer, and not with the Company, which rate he would pay—these provisions being always to be interpreted against the promoters of a Bill, and in favour of the public. Therefore, the person to whom this advantage was to be granted would have his choice, and not the Company.

Sir R. T. Reid said if the option was with his friend, he should not question his conclusion.

Mr. Duke said it had been previously stated that Private Acts were to be considered like covenants between a grantor and a grantee, and that the construction was to be against the grantor. On these grounds, he submitted that the judgment ought to be in his client's favour.

Sir R. T. Reid, in reply, said his friend's client had exercised the option for thirty years of paying on the higher rate. He would only say one word on the question of costs, which his friend had mentioned—viz. that as the difference between the gross and the net value was about one-fourth, the income of the Company would be diminished in like proportion; and therefore it was not unreasonable that they should come to the Court to get a decision. But, of course, the whole question of costs was in his Lordship's hands. Everybody used to think that annual value and rack-rent meant the same thing; but the House of Lords had instructed them that it was something different. He entirely contested his friend's proposition that the option in this case lay with the consumer. With regard to his criticism of the language of the Act, he said the rate per cent. per annum must obviously refer to the value previously mentioned—either the annual value or the rack-rent. Since the decision in the Dobbs case, the Company had charged on the lower rate in the district covered by the Act of 1853, and on the gross value within the limits of the 1861 and 1866 Acts; and he submitted that they were justified in so doing.

Mr. Duke then mentioned two cases on which he founded the proposition of law with regard to the interpretation of the Act—viz., *Stourbridge Company v. Watey* (2 Barnswell and Adolphus) and *Parker v. Great Western Railway Company* (7 Scott's Law Reports).

His Lordship reserved judgment.

COUNTY OF LONDON ASSESSMENT SESSIONS.

Sessions House, Clerkenwell, E.C.—Wednesday, April 7.

(*Before Mr.* W. R. M'Connell, *Chairman, and a Bench of Magistrates.*)

The Assessment of the South Metropolitan Gas-Works.

It will be remembered that, at the close of the address of Sir E. Clarke, in summing up the case for the above-named Company, on the 19th ult., as reported in the "Journal" a fortnight ago, the Chairman stated that the Court would consider their decision. This was given to-day.

The Chairman: In the case of the South Metropolitan Gas Company, which has been before us for a great length of time, the Court have considered very carefully the figures, having devoted a day to the purpose. We find the gross rateable value of the whole hereditament, *plus* rates, to be £414,164. We find the gross value of the service mains to be £270,193; and the rateable value of the mains, £140,272. We direct (following the precedent of *The Gaslight and Coke Company v. The City of London Union*) that the parties confer together, and furnish the Court with a tabular statement showing the results of the apportionments of these figures between the various parishes which are parties to the appeal. The Court will reserve the question of costs until they have been furnished with the apportionment statement.

Sir E. Clarke: Your Lordship has given the figure of £414,164 as the gross value including rates.

The Chairman: Yes.

Sir E. Clarke: Then the rateable value of the service mains is also *plus* rates.

The Chairman: No; the rates are taken off there.

Mr. Marshall (representing various respondents): Do I understand that the last figure, £140,272, is the rateable value of the service mains—that is to say, after taking off the rates?

The Chairman: Yes.

Mr. Marshall: Then will your Lordship say when it will be convenient to receive the reports of the valuers in regard to the apportionments as to how it works out.

The Chairman: The Court will leave that to you to agree as soon as possible; and then we will meet, adjust the costs, and give judgment.

Mr. Marshall: Then your Lordship will fix on a day when, on receiving the figures, you will give a further judgment?

The Chairman: Yes.

PRESCOT POLICE COURT.—Tuesday, April 6.

(*Before Messrs.* J. Stone *and* Jowett.)

The Liverpool Corporation and the Water Supply of Prescot.

The Liverpool Corporation were to-day summoned on two informations with having neglected (1) to keep a constant pressure of water in their water-pipes at Prescot, and (2) to furnish a constant water supply. The informations were laid by Philip Brady, of 6, Hill Street, Prescot. The case was really a test one, brought by the Ratepayers' Association, as for a considerable period there has been great dissatisfaction in the township concerning the water supply. A number of ratepayers' meetings have been held, and the subject has been discussed at the meetings of the Sanitary Authority.

Mr. Collingwood Hope appeared for the Ratepayers' Association; Mr. Thomas Swift for the Corporation.

Mr. Hope pointed out that the information was laid by Philip Brady;

and the charge was that on March 29 the Corporation neglected to provide a proper water supply to his house. Prescot was on the direct line from the Rivington reservoir; and the information was laid in consequence of various sections of the Corporation's Acts of Parliament. The first Act dealing with the subject was that of 1847; but the Act of 1862 very much modified it—section 25 stating that the water need not be laid on under a pressure or supplied at an elevation greater than could be afforded by gravitation from the Corporation works. This Act (continued Mr. Hope) remained in force until 1866, when another Act was passed which enacted that the Corporation should supply the inhabitants "unless prevented by unusual drought, frost, or other unavoidable cause or accident, or during necessary repairs or during any year in any part of the first six months whereof the storage reservoirs of the works of the Corporation at Rivington shall be reduced to one-half the quantity they are capable of containing; and the Corporation shall not be obliged in any of the above events to have the water constantly laid on or at such a pressure as will make the water reach the top storey of the highest houses within the limits of supply." This section, Mr. Hope contended, by implication repealed the earlier Act, which described pressure by gravitation. He went on to state that, on the day in question, the water at Brady's house was not on after six o'clock in the evening; and the occupier was unable to get water until the following morning. Though his friend might contend that the 1862 Act was still unrepealed, yet, assuming that contention to be correct, he would ask the Bench to say that the Corporation could supply water to this house or any other house in Prescot from the tank at Montrey House, which was part of their works. Mr. Hope went on to contend that the 1866 Act was repealed by a further Act of 1880, which gave the Corporation power to supply the town from Vyrnwy. He understood that the Corporation turned the water off at night so that the tank might be full in case of fire; but no matter what their reason, they must fulfil their obligation.

Mr. *Brady*, the complainant, Mr. *H. Mercer*, and Mr. *W. Goldsworth*, Surveyor to the District Council, then gave evidence in support of the case.

Mr. SWIFT, for the defence, said Mr. Hope had not pointed out any Act which expressly repealed that of 1862. As to the supply to Mr. Brady's house, it was not furnished by gravitation alone. It was not supplied during the daytime by gravitation, because in 1872 the Corporation, in order to improve the supply of water to Prescot, volunteered to build a pumping-station and tank; and, by means of this tank, they did supply during twelve hours each day of the week, and some little time less on Saturday and Sunday, every house in Prescot.

Mr. *John Kirby*, Superintendent of the Prescot pumping-station, said when he first knew Brady's house, it was supplied by a storage cistern, which, however, had been removed. If it had been allowed to remain, the house would have had a good supply of water during the night.

Mr. *Joseph Parry*, Chief Engineer of the Liverpool Water-Works, said they supplied all the water it was possible to supply by gravitation only to Prescot; but they could not supply the forty or fifty houses of which Brady's formed one by gravitation alone. The pumping-engine and tank were artificial means, and could not be called gravitation. It was not possible to supply Prescot from Montrey House reservoir without laying a supply-pipe—a thing not contemplated by the Corporation, and for which they had no powers under any Act.

The Bench thought the complainants had made out their case, and imposed a fine of 20s. and costs, but stated a case for appeal.

The Crystal Palace District Gas Company's Appeal.

At the West Kent Quarter Sessions last Thursday, before Mr. J. G. Talbot, M.P., and a bench of Justices, the appeal of the Crystal Palace District Gas Company against the conviction by the Bromley Magistrates for supplying gas of less than the standard illuminating power required by their Act of 1893, was heard. It will be remembered that the prosecution was instituted by the Beckenham Urban District Council, and a fine of £5, with £5 5s. costs, was imposed (see *ante*, p. 241). Mr. Low, for the respondents, said Dr. Rideal, the Council's Gas Examiner, tested the gas on the 12th of January, and found that it was only equal to 14·06 candles. The test was made in strict accordance with the statute, and in the presence of one of the Gas Company's officials—Mr. R. A. Gandon, their tester. Dr. Rideal said he carried out the test as he had always done during the three years he had been the Gas Examiner for Beckenham, and did not reverse the disc after making five of the ten statutory observations for arriving at the average of the illuminating power. The turning of the disc was not necessary for his tests, though it was part of the Instructions of the Metropolitan Gas Referees to do so. Mr. Germaine, for the appellants, urged that the result of the testing made by Dr. Rideal could not be relied upon, as a portion of the disc was defective; and, consequently, without reversing the disc no accurate computation could be obtained. Dr. Otto Hehner, Mr. William Sugg, and Mr. R. A. Gandon agreed that this was so; and Counsel urged that, as discs were so very liable to get oue of order, and thus display inaccurate results, it was a necessary part of Dr. Rideal's duty to test with both sides of the disc. The Court dismissed the appeal, but consented to state a case for the High Court of Justice.

Fraudulently Obtaining Gas Stoves and Fittings.

At the East Kent Quarter Sessions last Tuesday, Henry Heath, *alias* Heath Hellyer, was indicted on eight counts for unlawfully obtaining credit to the amount of £20 and upwards without disclosing his position as an undischarged bankrupt; one of the prosecuting firms being Messrs. Richmond and Co., Limited, from whom he had obtained goods of the value of £25. The evidence given disclosed a systematic course of swindling on the part of the prisoner, who sent out elaborately-printed bill heads, dated from Heath House, Lydd, which turned out to be a small shed. For upwards of ten years, the prisoner had succeeded in obtaining all sorts of goods and appliances from every part of the country; the list including gas-stoves, gas-burners, piping, and fittings—in fact, anything which he or his neighbours required. His Honour Judge Selfe, who presided, said he had had experience of the prisoner in nearly every County Court in East Kent, and knew he had for some years been carrying on this system of fraudulent trading. He (Judge Selfe) had repeatedly advised his prosecution; but, for some reason or other, this had only been done on one occasion, when Heath was sentenced to twelve months' imprisonment. As soon as he came out of prison, he resumed his practices. He would now be sentenced to two years' imprisonment, with hard labour.

The Rating of the Torquay Gas-Works.

At the Torquay Police Court, on Monday last week, the Torquay Gas Company were summoned, through their Secretary (Mr. J. Kitson), for non-payment of poor-rates, amounting to £143 7s., made on Oct. 13, 1896. It appeared that in 1895 the Overseers increased the gross value of the Company's works from £3000 to £3500, and the rateable value from £2400 to £2800. The Company appealed; and it was arranged that the dispute should be settled by two experts—Mr. Eve acting on behalf of the Assessment Committee, and Mr. T. Newbigging for the Company. They inspected the works, but did not agree as to what the actual figure should be; and it was proposed that the matter should be referred to a third party. This course, however, was not adopted. Mr. Eve reported to the Committee, advising a reduction of the assessment from £3500 to £2800 gross, and from £2400 to £1920 rateable value. The Committee said they were prepared to act upon this, but thought it advisable to postpone their final decision until a meeting on the 29th inst. In the meantime, the Company had been summoned to pay on the £2800. Mr. J. Carter, who appeared for the Company, asked the Bench to adjourn the matter pending the appeal. Mr. Glanfield, the Assistant-Overseer, who appeared in support of the summons, said the whole amount claimed of the Company had been paid to the Union; but an undertaking had been given to refund any overcharge after the settlement of the dispute. He urged that the Bench had no option but to make the order for payment. Mr. Carter contended that they had discretionary power in the matter, and could allow the summons to stand over. The Bench, having conferred in private, unanimously decided to grant the order for payment.

Using Spent Gas Lime for Mortar.

At the Birkenhead Police Court on Monday last week, a summons was heard, at the instance of the Corporation, against Walter Roberts, a builder, of Waterloo, for unlawfully using in the erection of certain houses mortar by which the bricks were not properly bonded together, and which was not good mortar according to the bye-laws. Mr. J. Fearnley, the Deputy Town Clerk, who prosecuted, stated that when the Borough Surveyor inspected the premises he detected a strong, nauseous, and sickening odour which emanated from the mortar being used in the building operations; and he instructed the Building Inspector to make an investigation. The inspector found that the mortar used was being ground away from the building, at some old quarry, and that spent gas lime was employed in its manufacture, and no other was being used with it. The Borough Surveyor was of opinion that this could not be considered to be good lime within the meaning of the bye-laws. Mr. Collingwood Hope, for the defence, submitted that there had been no contravention of the bye-laws. Mortar had been manufactured from gas lime for some years past; and the Corporation themselves had used mortar made from such lime in one of their departments. Surely there should not be one law for the Corporation and another for the builders. A builder was called, and stated that he had been using mortar made from gas lime for the past eighteen months, and had never been prosecuted. In his opinion it was a very good mortar, and bonded properly. A number of other builders were called, and deposed that the mortar in question was good. The Bench held that the walls of the buildings in question were not constructed with good mortar; and they imposed a fine of 20s. and costs.

A Disputed Gas Account.

At the Plymouth Police Court, yesterday week, Mr. J. P. Dobell, a solicitor, was summoned, at the instance of the Plymouth Gas Company, to show cause why a distress warrant should not be issued for £2 11s. 11d., alleged to be due to them. Mr. Shelly appeared for the Company; the defendant conducted his own case. Mr. Shelly said the proceedings were taken under the Company's Act of 1855; and the money for which distress was sought was for gas supplied during two quarters. The defendant wrote to the Company on Aug. 5, 1896, complaining about the supply of gas, alleging it to be the fault of the wet meter which the Company had put up. On Oct. 26, he again complained, and asked for a dry meter to be placed in the house, or for permission to put one in. The meter was found to be quite right; but a dry one had since been supplied, and, as a matter of fact, more gas had been registered by it than by the wet one. Several witnesses were called to prove that the wet meter registered the quantity of gas for which payment was now demanded, and that the meter on being tested was found to be correct. Thomas Gibbons, the Company's collector, said the defendant had offered 30s. in settlement. The quantity of gas consumed in the June quarter last year was 10,600 cubic feet; and in the June quarter, 1895, 5900 cubic feet. The Company refused to let dry meters on hire; but they had no objection to their being placed in houses at the cost of the consumers. William Finch, an inspector of meters, stated that the meter about which defendant complained was fixed in 1892. It was not a new one, but it was tested before being put up, and after its removal it was found still to be correct. The dry meter showed that in the quarter just ended the consumption of gas was 19,000 cubic feet, which was in excess of previous quarters. Mr. Dobell said he did not wish to avoid any legal or moral liability as to the previous period, but as he wrote to the Company refusing to take gas through a wet meter, he contended that he was not liable. The Bench found that, the gas having been consumed, a distress warrant must be issued for the amount; but they made no order as to costs.

MISCELLANEOUS NEWS.

THE SUPPLY OF WATER GAS IN BIRKENHEAD.

Report by Professor Vivian B. Lewes.

In view of the alarm which was recently created in Birkenhead and elsewhere by certain newspapers, in regard to the supply of carburetted water gas for illuminating purposes, the Gas Committee of the Birkenhead Corporation instructed Professor Vivian B. Lewes to investigate and report upon the subject. This he has done; and the principal portions of his report are as follows:—

Having honoured me with instructions to investigate and report to you upon the safety (or otherwise) of the proposed admixture of carburetted water gas with coal and cannel gas for the town supply of Birkenhead, and also as to the relative value of such a mixture as compared with normal coal and cannel gas of the same illuminating power, I beg to state that the conclusions I have arrived at are—

1.—That there is no danger in sending out as a town supply a mixture of coal and cannel gas with carburetted water gas, provided that the carbon monoxide in the mixture does not exceed 17 per cent., which, with the two gases as at present made, would give a limit of 50 per cent. of water gas.

2.—That mixtures containing 50 per cent. and under of carburetted water gas are for all practical purposes as good as cannel and coal gas, whilst for use in incandescent mantle lighting they are superior.

Professor Lewes then goes on to show that the mixture as sent out is about half and half; that it is not quite such a good illuminant as coal gas; and that it has over 5 per cent. less value as a heater. The mixture contains more than twice as much carbon monoxide as does coal gas. The ordinary fittings and burners, he remarks, suffice for a half-and-half mixture, but would not do for pure water gas. He then says, in regard to the poisonous properties of the gas:

It must be clearly borne in mind that carbon monoxide is the most dangerous gaseous poison there is; and the attempts made by some supporters of carburetted water gas to gloss over this fact are as mistaken as they are mischievous.

The only proper way to attack this question is to grasp the fact of the dangerous properties of this gas, and then to so arrange the percentage of it in the town supply that, only under abnormal and accidental conditions, impossible to prevent, should it become dangerous; the same conditions being equally a source of danger with the ordinary gas supply.

The smell of carburetted water gas being even more penetrating than that of coal gas, a leakage becomes apparent to the nose when the air contains 1 of gas to 10,000 of air—a proportion absolutely without action on health. From this it follows that it would only be during sleep that the leakage of a sufficient quantity of carburetted water gas to become dangerous to life could happen; and the leakage under the circumstances would only take place from carelessness in turning the gas on or off. In any case the amount of gas escaping into a room under these conditions will not exceed the amount passed by an ordinary flat-flame burner, or, say, 6 cubic feet per hour. A small bedroom will contain at least 1000 cubic feet of air space; and experiments which I have made show that, in a room of this size, containing a fireplace, a door, and a window, the two latter being closed and no fire in the grate, the whole air in the room is changed at least twice in an hour, generally nearly three times.

Dr. John Haldane, in his now much-quoted work on the effects of carbon monoxide on life, not only experimented on mice, but also tried the effect on himself, and found that 0·05 per cent. of carbon monoxide in air begins to have an appreciable effect, but can be inhaled for four hours without very marked symptoms; and for all practical purposes, therefore, 0·05 per cent. may be taken as the margin of safety. If gas escapes into a room having a capacity of 1000 cubic feet, at the rate of 6 cubic feet per hour, whilst the air of the room is changed twice in the hour, then after three to four hours the percentage of gas will rise to 0·3 per cent., and the rate of leakage and of removal by the changing of the air will become constant, and the percentage of gas will not rise above that point, however long the leakage may continue.

It has been shown that 0·05 of carbon monoxide may be inhaled for four hours without dangerous symptoms; and this amount of carbon monoxide will be present if it constitutes one-sixth, or 16·6 per cent., of the mixture. Approximately this composition is arrived at with a mixture of one-half coal and cannel gas and one-half carburetted water gas; and it should be clearly understood that this proportion should not be exceeded. Under these conditions, I am of opinion that the mixture is perfectly safe as a town supply.

Is carburetted water gas a cumulative poison—*i.e.*, can it be inhaled in small quantities and retained in the system day by day until health is undermined? In the continuous breathing of small percentages of carbon monoxide, this might be the case; but if there is any change of *locale*, it would be practically impossible. A person sleeping in a room with a leaky gas-fitting might each night take into his system a small trace of the gas; but in his outdoor life in the daytime this trace would be eliminated, so that unless confined to one apartment for a very long period, no such action would be likely to happen. In my experience, men exposed to this gas in working producers, &c., soon get used to its effects, and show no loss in health.

THE MANCHESTER GAS COMMITTEE AND THE INSPECTION OF BOOKS BY BURGESSES.

In presenting the minutes of the Gas Committee for adoption at the meeting of the Manchester City Council last Wednesday, Mr. Alderman Gibson called attention to the case of *Williams and Another v. The Mayor and Corporation of Manchester* (as reported in the "JOURNAL" for the 23rd ult.), in which it was declared that "in future the burgesses of the city of Manchester are entitled to inspect the acts of the Committees submitted to the Council of such city for approval." He said that Mr. Norbury Williams, one of the Citizen Auditors and one of the plaintiffs in the case, had written a letter to the papers in which he claimed to have wrung something from the Corporation, and to have gained a victory over them. Now, in the first place, when one asked for something and did not get it, it was extraordinary to call it a victory. The plaintiffs demanded that the minute-books of the Committees should be open to their inspection; and this was what the Court of Queen's Bench would not allow. It was a roving commission to see the minute-books for two years that Mr. Williams demanded; and all that had been conceded was that the acts of the Committees submitted to the Council for approval were to be seen by the burgesses. As for the costs, it was wrong to say that the Corporation were condemned in costs; they had agreed beforehand that, if the matter at issue could be tested in a Court of Law, the Corporation would pay the costs. Regarding the Gas Committee's books, he, as Chairman, had allowed Mr. Williams full access to all of them. He had permission to enter every office and interrogate the clerks; and some of the latter he had kept after the usual working hours to help him in his investigations. All this was allowed as a matter of courtesy; but he was refused when it was demanded as a right. When, however, Mr. Williams so far lost himself as to forget that these were concessions made to him in courtesy, and demanded to see the books for two years back, without saying what he wanted to inspect them for, he (Alderman Gibson) maintained that it was time somebody put his foot down, and that was what they had done. Mr. Williams had not only not gained anything for himself as Auditor, nor for the public, but he had lost that which he had. Alderman Southern questioned the wisdom of any Committee being allowed to commit the Council to the payment of costs of both sides. He would like Alderman Gibson to tell the Council what the costs had been, because it seemed to him they were pretty much where they were before the action. Alderman Gibson said he could not say what the bill would come to. That of the other side was £100. The matter then dropped.

STOCKTON CORPORATION GAS-WORKS.

Retort-House Improvements—The Gas Engineer and the Discharge of Workmen.

At the Meeting of the Stockton Town Council last Tuesday, the Gas Committee, on the suggestion of the Gas Engineer (Mr. W. Ford), recommended that the tender of Messrs. Drake and Son, of Halifax, amounting to £3500, be accepted for the provision of regenerative furnaces. These, it was stated, would give 25 per cent. increased carbonization, and a saving in fuel of about 20 per cent. It was also reported that the Committee had been in receipt of letters from Mr. W. Lynas, of the Gas Workers' Union, with reference to the discharge of workmen by the Manager from the gas-works. Having duly inquired into the allegations contained in the communications, the Committee declared themselves satisfied with Mr. Ford's explanation, and were of opinion that no workman had been "improperly discharged." The adoption of the minutes having been proposed and seconded, regret was expressed by Mr. Smith that the Committee had not seen their way to receive a deputation from the men's Union or from the workmen affected. Mr. Vickerson endeavoured to have the minutes varied by the substitution of these words in the paragraph referring to the workmen: "That the Committee, having heard Mr. Ford's explanation, decide to receive a deputation of workmen's representatives." He urged that there was a grievance inasmuch as old servants had been discharged and their places taken by new men. Mr. Smith seconded the amendment. Alderman Richardson, the Chairman of the Committee, was making some remarks in reply, when he was interrupted by some irritating observations by Mr. Vickerson. When he was able to proceed, Alderman Richardson spoke in high terms of Mr. Ford's management. He said Mr. Ford had not been Manager for a month or so, but for a great number of years; and he would rather retire from the Chairmanship than not support their Engineer, whom he always found treated his workmen with every consideration. Alderman Samuel, M.P., held that if the Gas Committee considered they had a strong case, they should not object to allow an official or one or two of the men to come before them and argue the matter with the view of their understanding the actual basis and cause of the complaint. Some of the members expressing ignorance of the nature of the complaint from the men, one of the letters from Mr. Lynas was read. It stated that he had received complaints that Mr. Ford had not been treating the men fairly. It seemed that he was reducing the staff, stopping the old hands while the new hands were kept on. This, the letter said, was an unfair way of dealing with the workmen, and did not redound to Mr. Ford's credit. After some desultory conversation, Mr. Ford rose and claimed privilege, as the oldest servant of the Corporation, to be allowed one or two words in his own defence. The accusations that had been brought against him were of such a serious nature that it was only right that he as a public servant should be permitted to make an explanation. Mr. Vickerson interrupted Mr. Ford; and this led to quite an animated scene. On Mr. Ford being allowed to resume, he said he had endeavoured to do his duty during the 30 years he had been in the service of the Corporation. They were well acquainted with the fact that the gas-works were highly rated; and his first duty, under the direction of the Gas Committee, was to produce such an amount as to materially assist the rates and taxes of the borough, and to make as good and economical a light for the district as it was possible to do. Whether he had succeeded in this, he left to public opinion. He had men with him who had been in his employ for 40, 36, 32, 24, 20, and 16 years; and if he was the arbitrary man that a few who were egged on by certain emissaries of an association would make him out to be, those men were not likely to have stopped in his employment so long. They wanted him, like Judas Iscariot, to compel the few men that were not Union men to join the Union; and sooner than he would do such a contemptible trick, he would immediately leave the service of the Corporation. To come to the matter in point, he read a list of men who had been simply displaced in the ordinary course of duty. Twenty-seven men out of about sixty had left the works; but it was merely because there was no work for them; and he pledged his word that no old men had been discharged for a new hand. On the amendment being put, it was rejected by 10 votes to 21; and the minutes were adopted in their entirety.

GAS-WORKS EXTENSIONS AT ST. HELENS.

In the minutes presented at the meeting of the St. Helens Town Council last Wednesday, was a proposal to extend and reconstruct part of the works at a cost of £25,000.

Alderman Cook, in proposing the confirmation of the minutes, said in January last they had a report from their Engineer (Mr. S. Glover), in which it was stated that he had reached the full extent of the producing capacity of the works. The largest delivery of gas they had had for any twenty-four hours was the day before Christmas, when 1,352,000 cubic feet of gas were consumed in the town; and on several other days, the consumption amounted to 1,250,000 feet. Their producing capacity was 1,200,000 cubic feet per day; or, if every retort in the place was at work, which was not practicable, the total produced was 1,280,000 cubic feet. The heaviest day's consumption was therefore considerably more than the entire producing capacity. Since the last extension was made, the consumption had increased 72 per cent., or about 6 per cent. per annum. The extension that was now recommended was for an increased producing capacity of 750,000 cubic feet per day, or equal to about 70 per cent.—that was to say, that what was now recommended was about the same extent of producing capacity as the last extension amounted to. With the suggested increase, they would have a capacity of 2 million cubic feet a day; and they estimated that the extension would be sufficient for the next ten years. When the extension was made, the whole of the land available on the gas-works site would be covered. They might, however, within a few years, have to ask for additional storage. The present three holders were only equal to 1,700,000 cubic feet—in other words, the total of their holding capacity was only a little more than the largest daily consumption. Two causes had contributed to the increased consumption. First, there was the introduction of coin or prepayment meters, whereby large numbers of cottagers were now using gas. Twelve months ago, the cash received for the year from these meters was £1661, which was equal to about 11,250,000 cubic feet of gas. For the past year, the cash received from the meters was £3069, or an increase of £1407. The second cause that had contributed to the increase was the discontinuance of the rents for meters and stoves. Since this was done, they had had an enormous demand all over the town for stoves; and consequently more gas had been consumed. The gasholders needed repairing; and No. 2, which had been in use for twenty-six years, would have to be entirely reconstructed. They wanted additional purifiers, and also new mains in many parts of the town. They had included all the work in order to get sanction to the borrowing of the money, which could be used when necessary.

Mr. Beecham seconded the motion.

The Mayor (Alderman R. Pilkington) said he would like to point out that the position of the gas-works was highly satisfactory. The capital laid out there was £250,000; and they had paid the debt off until it now only amounted to £175,000. In addition, they had paid large amounts in alleviation of the rates every year. The extension was only a proper and reasonable one; and it was not made any too soon.

The motion was adopted.

ROTHERHAM CORPORATION GAS SUPPLY.

The Water-Gas Question—The Coal-Gas Plant to be Extended.

At the Monthly Meeting of the Rotherham Town Council last Wednesday—the Mayor (Alderman G. Neill) presiding—the Gas Committee reported that the Sub-Committee who were appointed to visit Liverpool for the purpose of making inquiries as to the use of water gas there before determining on its adoption for Rotherham, had reported that they considered a mixture containing 25 per cent. of carburetted water gas and 75 per cent. of coal gas might be safely used in the borough. The Special Gas Committee were therefore of opinion that, if used with care, carburetted water gas might be utilized as a mixture with ordinary coal gas to the extent mentioned. The Committee also recommended that a Consulting Engineer be called in to advise as to the laying out of additional coal-gas plant together with an installation of water-gas apparatus for producing a quantity not exceeding 500,000 cubic feet per day.

Mr. G. Gummer, in moving the adoption of the recommendations, referred to the report of the Sub-Committee as to the use of carburetted water gas. He said it appeared to him that the reason the Committee were sent to Liverpool was on account of certain statements made in the Council as to the effect carburetted water gas had had upon the inhabitants of Garston; and the report of the Sub-Committee showed that they were quite satisfied that the statements which had appeared in the newspapers on the subject were exaggerated. The Committee had passed a resolution advising that carburetted water gas, if used with care, might be utilized as a mixture with ordinary coal gas to an extent not exceeding 25 per cent. They had been told for a number of years that their present means of gas supply were very much overtaxed; and their Manager (Mr. Murdock) had said it was impossible to lay down coal-gas plant of sufficient size to carry them through next winter. It was only in the sense of an auxiliary that the question of water gas was brought before the Corporation. Since the visit to Liverpool and the meeting of the Committee, he had ascertained that it was possible, by a scheme to be carried out in its entirety if the Corporation would only set about it in earnest, to have a sufficient number of coal-gas retorts ready to carry them over next winter, and to continue the scheme during the winter, so that in the following winter they would be able to double their present output. In view of this fact, and also that ever since the question of carburetted water gas had been brought before the Council there had been a great deal of unnecessary feeling introduced, and that there was a strong minority opposed to it, it was not his desire personally to push the question of its use, if coal gas could be obtained and was preferred. His anxiety was to see the gas-works in a position to cope with a demand that was gradually increasing; and now that he was assured by an eminent authority that the supply of coal gas could be carried out if certain arrangements were made, he (the speaker) had no objection. He would not, therefore, oppose the elimination of the words recommending the adoption of water gas. At the same time, he was bound to say he was of opinion that the day would come when the Corporation would be only too pleased to have carburetted water gas as a part of their plant.

The Mayor seconded the motion.

Mr. F. Mason moved the elimination of the clause referred to, so that it should read "That the Committee recommend that a Consulting Engineer be called in to report and advise as to the laying out of additional plant for making coal gas"—leaving out the words "together with an installation for making a quantity not exceeding 500,000 cubic feet per day of carburetted water gas." He differed from the statement of the Chairman that there was a "minority" against the adoption of water gas, as he had a strong opinion that there would be found to be a majority.

Mr. Cox remarked that more than twelve months ago the Council appointed a Committee to examine and inquire at various places as to the working of the system of making water gas; and every report they had received had been in favour of it. He therefore thought there should be some consistency in the action of the Council; and there ought to be some more solid reasons than the Chairman had given for such a sudden change. Anyone who read the evidence must come to the conclusion that there was no real danger in the use of carburetted water gas. The whole thing was a scare; and there were other reasons than those which had been alleged for the change-about-face they had witnessed that day. He sincerely hoped the Council would stand to the minutes of the Committee.

Mr. Bryant considered the Committee had acted with consistency. They had been faced with a difficulty, and that was how to secure a supply of gas for next winter. They had been under the impression that it was impossible to put down plant for coal gas; but they could now see their way to provide it. With regard to water gas, he maintained there was danger in its use.

The Mayor thought there was no necessity to argue over again the question whether carburetted water gas was injurious to health.

Mr. Gummer defended himself against the charge of inconsistency, and pointed out that the Committee had been of opinion they had no way out of the difficulty except by the adoption of carburetted water gas. Now they could get a supply of coal gas without risk of putting the town in darkness next winter, he contended they were justified in doing so.

Mr. Hickmott agreed that they should extend their coal-gas plant; but why, he asked, should they not have the opinion of the Consulting Engineer on both kinds of gas? The bulk of those members who had voted against the adoption of water gas were those who had not been round the country to see its operation. His candid opinion was that the use of water gas would come, and that they were doing wrong that day in throwing it back.

Mr. Copley was convinced that he would act in the interests of the burgesses in voting against the adoption of water gas.

The Mayor said he did not think the Chairman of the Committee had given himself away; for, in his concluding remarks, he had said he still had perfect faith in water gas. He thought it did not reflect much credit upon Mr. Murdock that he had not before seen that coal-gas plant could be put down by the time required. He urged the Council to pass the amendment unanimously.

Mr. Gummer explained that the scheme he had in mind was one prepared by their late Engineer (Mr. C. B. Newton), who was ready to take the supervision of carrying it out as Consulting Engineer.

The amendment was unanimously agreed to.

Mr. Newton was afterwards formally appointed Consulting Engineer for the new works.

THE IPSWICH DOCK COMMISSION AND THE GAS COMPANY.

Coal and Coke Dues.

The principal business before the Ipswich Dock Commission last Friday was a special report by the Committee of Management as to "the interpretation of section 53 of the Act of 1852 with respect to coke." At present the Gas Company are allowed a drawback of the duty payable on the coke they manufacture and send out of Ipswich; and a question had been raised by Mr. T. Alderton as to whether the permission to allow a drawback was applicable only to coke brought into the town and sent elsewhere, or might it be made to include coke manufactured in Ipswich? The report of the Committee dealt with the section governing the matter in the Act of 1852; and it mentioned that the first claim made and allowed to the Company was in 1854. The section, in the opinion of the Committee, authorized the allowance of a remission on coal and coke exported or transhipped, and did not draw any distinction between coke imported or coke manufactured, and which had paid duty as coal. The section, they considered, was clearly permissive; and no question could arise as to the discretion of the Commissioners to alter and entirely disallow any drawback as might be thought politic to meet the exigencies of trade, and again to allow the same or any other remission, not exceeding the maximum fixed by the section. In the discussion on the report, one or two speakers contended that the drawback was illegal. Mr. J. T. Jolliffe, the Engineer of the Gas Company, and one of the members of the Commission, said he hardly knew whether or not he ought to speak on the question. He should like to point out, however, that apart from its legal aspect, a much broader issue was involved as affecting the interests of the Commission. Gentlemen who had spoken of the benefit derived by the Gas Company from these drawbacks on coke, which meant a matter of £200 to £300 a year, had perhaps lost sight of the fact that the Company paid some £2000 a year in coal dues. He would ask them to bear in mind, however, that the Company were not confined to coal for gas making. Other materials could be employed for the purpose; and if the Commission drove the Company into a corner by trying to take away from them a certain revenue which they had derived from these drawbacks, the Company would be compelled to adopt other systems. If so, it was quite possible that the coal dues they paid would not amount to half the figure at which they now stood. He knew of a town within one hundred miles of Ipswich where the consumption of coal had been reduced by one-half through the adoption of other means of making gas. This was a consideration which he simply advised the Commissioners not to ignore. It was decided that the Committee of Management should state a case for the opinion of Counsel as to the interpretation of the section in question.

SALES OF STOCKS AND SHARES.

On Monday last week, Mr. Alfred Richards conducted, at the Mart, Tokenhouse Yard, E.C, a large sale of debenture and ordinary stocks and shares in gas and water undertakings. A parcel of £6250 of 4 per cent. perpetual debenture stock of the Lea Bridge District Gas Company, authorized to be issued under the Company's Act of 1878, was disposed of at £125 per £100. Some £5 fully-paid ordinary "C" shares in the Northfleet and Greenhithe Gas Company, Limited, were sold, with the dividend (8½ per cent. was the last paid) accruing from the 1st prox., at £10 and £10 2s. 6d. per share. A few £10 shares in the Peterborough Gas Company, carrying a 7 per cent. dividend, were knocked down at £17 each. A small parcel of 5 per cent. perpetual debenture stock of the Isle of Thanet Gas Company was sold at the rate of £145 per £100 of stock; the purchaser taking the interest accruing from Jan. 1. Some consolidated stock of the Brentford Gas Company, the last dividend on which was at the rate of 12 per cent. per annum, fetched from £291 10s. to £293 10s. per cent., *cum div.* from Jan. 1. Ordinary consolidated "B" stock of the Hornsey Gas Company, the last dividend on which was at the rate of 8 per cent. per annum, free of income-tax, fetched £196 10s. per cent. Some original £10 shares in the Harrow and Stanmore Gas Company were sold for £16 10s., £17, and £18 apiece; some "C" shares realizing £12 5s. each. A few £5 shares in the Goring and Streatley District Gas and Water Company were bought for £2 15s. each.——Among other sales last week, the following may be noted: A parcel of £25 shares in the Bradford-on-Avon Gas Company fetched £39 each, *ex div.* At Ipswich, four lots of £10 "A" stock in the Ipswich Gas Company realized £30 each; and eight similar lots, £30 2s. 6d. each. Three lots of £10 "B" stock in the same Company were knocked down at £25 5s. apiece. At the Mart, Messrs. Edwin Fox and Bousfield sold some £5 shares in the Cobham Gas Company at £5 to £5 10s. each. On Friday, four lots of £50 of "A" stock of the Tonbridge Gas Company secured £139 each; three lots of £50 of "B" stock fetched £102 each; one lot of £60 of similar stock, £120; and one lot of £52 10s. of "C" stock, £65. Two lots of ten £5 shares in the Tonbridge Water Company made an average of £10 5s. per share.

THE ALUMINIUM AND CALCIUM CARBIDE WORKS AT THE FALLS OF FOYERS.

At the Second Ordinary Meeting of the British Aluminium Company last Thursday, at which the Directors recommended the payment of a dividend of 7 per cent. on the preference shares up to Jan. 1, 1896, the Chairman (Mr. R. W. Wallace) gave an account of the progress and prospects of the undertaking, allied with which, as our readers are aware, is that of the Acetylene Illuminating Company. He said the Directors had experienced difficulties in getting the works started and in training the workmen; but these tasks had been accomplished satisfactorily. They had been at work since last September; and they had had the benefit of the experience gained from the vast amount of money spent by the allied companies in France and elsewhere in commencing the aluminium industry. The men were now trained, and they were improving every day. Passing on to describe the relative positions of the Company's works at Larne, Foyers, Greenock, and Staffordshire, he said the bauxite obtained from the mines in Antrim was turned into alumina at Larne; and this was thought to be 99 per cent. pure. It was then shipped to Foyers, where it was changed into aluminium. It took two tons of alumina to produce a ton of aluminium; the rest being oxygen, which was driven off into the air. The Directors had decided to have a factory at Greenock; and it had been completed during the past eight months. This was for the purpose of making electrolytic carbons, which were used for the anodes of the electrical furnaces at Foyers. Being near Glasgow, they obtained from the large gas-works the carbon coatings of the retorts; and when they shipped off their carbons, they could also send their coal to Larne, so that it cost them only 4s. 6d. a ton. Regarding the demand for aluminium, it was increasing at a very rapid rate; and the Company had no difficulty in getting rid of their supplies. They were not proposing, therefore, to reduce the price. Of course, they could reduce it considerably, because there was a large margin of profit; but they thought to do this might lead to too great a development in the demand at present. Regarding the water power they had, he said that without this they could do nothing. Besides the power in Foyers, they possessed it in other places, including a centre in Wales. They were about to develop it, and let a large portion to the Acetylene Illuminating Company. This Company were making carbide of calcium for the production of acetylene gas. He thought this would be a very considerable industry in the future in this country. The Aluminium Company had an interest in the Acetylene Company, and had rented to them certain power, for which they were paying very well. It was one of the great features of the Company, apart from the manufacture of aluminium, that, if they were to do nothing but let the water power, they would be able to pay dividends on the capital. To develop the water power at Foyers, they were increasing the storage capacity to 3000 million gallons, which would give them a supply for 100 days' working. The storage lake would be about five miles in length. The report was adopted.

ELECTRIC LIGHTING NOTES.

The Board of Trade have granted a Provisional Order to the Corporation of Brighouse for the supply of electricity, at a capital outlay of £10,000.

The Rochdale Corporation have adopted a recommendation of the Gas Committee, that application be made to the Board of Trade for a Provisional Order to authorize them to supply electricity for lighting and other purposes.

The Lighting Committee of the Liverpool City Council have decided to adopt an important scheme for the extension of electric lighting; the total cost being £22,000. They have also resolved to supply the street-lamps at 3d. per unit, in place of 4d. Under the old Electric Supply Company the charge was 7½d.

Among provincial dividend-paying electric lighting companies, that carrying on operations at Oxford is to be found. Last year, they made a gross profit of £3368; and at the annual meeting, they had, including £360 from the previous year, £2178 available for distribution. This enabled the payment of a dividend at the rate of 4½ per cent.

The Electrical Engineer of the Blackburn Corporation (Mr. A. S. Giles), in his report for 1896, states that the department has made a gross profit sufficient to pay interest and sinking fund charge for the year. The business nearly trebled during the year; and the rate at which new customers have been connected in the last six months exceeded the period when the sliding-scale was not in force by more than 100 per cent.

The original authorized expenditure on the electric lighting works of the Birkenhead Corporation (£20,000) has been exceeded by £3500; and the Council last Wednesday decided to apply to the Local Government Board for sanction to borrow a further £20,000 for the following purposes: For charges and expenses incurred in excess of the sum already borrowed, and to meet other expenses, £5000; for providing feeding and distributing mains and connections in the districts of Oxton and Claughton, £10,000; and for purchasing additional generating plant, £5000.

For the purposes of electric lighting improvements and extensions, the Portsmouth Town Council have applied to the Local Government Board for permission to borrow £10,000; and the customary inquiry has been held. Half the money, it appeared, is to be spent on additional accumulators and generators; £3000 for the duplication of feeders; and a portion of the balance for the purchase of property and the erection of a new boiler-house. It transpired during the proceedings that the Corporation are now supplying 34,400 lights, independent of the 260 arc lamps in the streets.

A recommendation of the Electric Lighting Committee was before the Derby Town Council last Wednesday, that the sum of £20,000 be granted for extensions of plant; and it gave rise to a lively discussion. It was pointed out by the supporters of the Committee that it was useless to attempt to cripple the electric lighting scheme by shortness of capital; while, on the other hand, the Committee's opponents endeavoured to prove that sufficient had already been expended, considering the unsatisfactory nature of the results achieved. On a vote being taken, the grant was agreed to by 27 votes to 23.

At last Tuesday's meeting of the Worcester City Council, Alderman Williamson moved that additional plant for the Powick electricity generating station be purchased and laid down, at a cost of £8800. He said that the plant was being worked up to a point dangerously near its maximum capacity; and it was a matter of necessity to provide extended plant for the largely-increasing demand for light and current. The plant would produce a handsome revenue, which he calculated would bring their accounts to the turning-point. During the 27 months they had been working, there had been no loss, except in respect of the amount paid for redemption of loans. This was to his mind eminently satisfactory. The motion was carried. The Brighton system of charging for light and current was also adopted.

Judging by the increasing profits of the Electric Light Company, this form of illumination is making headway in Sheffield. In 1893, the shareholders had to content themselves without a dividend; in 1894, the net profit was £1943; in 1895, £3300; and last year, it reached £7635. The disposable balance was £7723. Of this £1125 was required for interest on debentures, £445 for paying off the balance of formation expenses; and £1000 for the depreciation fund. From the balance of £5152, it has been decided to pay a dividend of 7½ per cent., and to transfer £1000 to the reserve fund; leaving £99 to be carried forward. The Directors consider it prudent to appropriate the sum named to the reserve fund, as they have reduced the price of current from 6d. to 5d. per unit, which means an immediate loss of revenue to the amount of £2000 per annum. The shareholders have authorized the Board to increase the capital from £98,000 to £280,000; but it seems this is only a precautionary step, as the Chairman (Alderman Franklin) stated, at the meeting of the shareholders last week, that there was no prospect for a year or two of any of the new capital being issued.

There is clearly a strong feeling in the Salford Borough Council that the Gas Committee are not doing enough to encourage the use of the electric light; and they were told so at the meeting of the Council last Wednesday. On the invitation of Mr. Boys, the members passed a resolution giving it as their opinion that it was desirable the Electric Lighting Department should be under separate management, and that the duties thereof should be deputed to a Special Committee to be nominated at the next meeting. In his remarks, Mr. Boys submitted that the fullest use was not being made of the electric plant, and that the Gas Committee had quite enough to manage in their own particular department. He entreated the Council not to allow "this infant to be strangled by its bigger brother;" and he prophesied that "some day the infant would be a giant." Mr. Holland, the Chairman of the Gas Committee, protested against the suggestion that they had neglected the electric light, and pointed out that a great deal had been done in asking the public by circulars to take the light. He asserted that there was no bias on the part of the Gas Committee in favour of gas. The fact that the resolution was passed by 33 votes to 8, indicates the feeling of the Council in the matter.

The Gas Committee of the Belfast Corporation have been called upon to further subsidize the electric lighting department. The Committee in charge of the latter are about to proceed with the erection of an extension to the present system; and at the meeting of the Corporation last Thursday, Mr. Young evinced some anxiety as to the probable cost of these works—and with good reason. The Electric Lighting Committee, he stated, had already got about £33,000 out of the Gas Committee's surplus funds; that day he had signed for them a cheque for £7500. The result of these sums being handed over was that the Gas Committee had had to overdraw their account to the extent of £10,000. Replying to these remarks, Mr. Andrews said the detailed estimate had not yet been made up; and therefore he could not specifically answer the question as to the cost before the next meeting. The department had, of course, been supported by the Gas Committee, of which the Electric Committee was originally an offshoot. He acknowledged having received from the Gas Committee the sum of £32,500; but they did not, he generously intimated, intend asking them for a further £15,000 which they required—it having been decided to apply to the Local Government Board for it. In his concluding sentences, he said that he hoped, as the Gas Committee had

nursed the Electric Committee in the days of their infancy and weakness, the latter would be able in the days of decrepitude of the former to reciprocate their liberality.

Major Cardew has presented his report on his investigation into the circumstances attending the fatality at one of the transformer stations of the Hampstead Vestry on the 6th ult., to which reference was made in our columns at the time. He says there can be no doubt that the unfortunate man White was killed by an electric shock. He was descending into the transformer chamber by means of a ladder; and he put one foot on the flat top of the case, which was evidently at the time charged to a high potential from earth, while the ladder on which he had his hands was in connection with earth by resting against the iron frame of the cover of the chamber, which was in contact with the wet earth under the pavement. White's boots were very wet at the time, and made good electric contact. In this way he received a very severe shock, which fixed his muscles, and prevented him making any movement to release himself. His companion Gill, who was waiting close to the entrance to the chamber, observed White's condition, but apparently could not effectively assist him, owing to the very limited space and the position of the body. Gill therefore ran to the generating station, and had the pressure cut off from the circuit. White was afterwards extricated; but it was found that life was extinct. Major Cardew says the accident was clearly due to the transformer case having become charged. It should have been impossible for this to occur; but, in his opinion, "the precautions taken were insufficient and illusory, and moreover were not in accordance with the system of supply approved by the Board of Trade. The fault in the high-pressure connection, by means of which the case became charged, was, it seems, caused by the insulation of the connecting wire having become damaged where it passed through the case. "This unfortunate accident," continues Major Cardew, "again directs attention to the dangers to which the employees of electric light undertakers using high pressure are exposed, and the necessity for some supervision and control of the means adopted by these undertakers for the prevention of such dangers, similar to that provided under the Factory Acts for the protection of employees from other recognized dangers." He then sets forth in detail the recommendations which should, he thinks, be brought to the notice of the Vestry for their immediate attention.

The Garston District Council and Water Gas.—At the meeting of the Garston District Council last Tuesday, a letter was read from the Liverpool Gas Company stating that, at a meeting of the Directors on March 24, the resolution passed by the Council with reference to the supply of carburetted water gas was considered; and it was resolved that the Council be informed that the whole subject had been very carefully and fully considered by the Board, who had arranged to have the two descriptions of gas so mixed as to meet the reasonable requirements of their customers. Captain Turner considered the resolution was very evasive. The Chairman (Mr. J. E. Sheppard) said there seemed to be an objection to stating the exact amount of water gas supplied. Two of the Directors had told him that they did not like to bind themselves to a fixed amount; but when the new arrangements were completed, the proportion of the two gases would be about equal. Mr. Rigby, in view of the statement made in the House of Commons recently that the President of the Local Government Board would cause an inquiry to be held on the subject of water gas, proposed that the Medical Officer be instructed to prepare a report on the question as it affected their district, and that the member for the constituency (Mr. J. S. Gilliat) be requested to give it his support. The motion was agreed to.

Gas Profits at Newcastle-under-Lyme.—In a report submitted by the Gas-Works Management Committee at the meeting of the Newcastle-under-Lyme Town Council last Tuesday, was a recommendation that £1000 should be transferred from the profits in aid of the rates. The adoption of the recommendation was moved by Alderman Briggs, who said the amount was considerably less than the Committee had handed over to the Council for some years; but there were two causes for this—one being the heavy drop in the prices received for residuals, and the other that the Committee had decided to place something to reserve. When they took over the works from the old Company in 1881, they created a depreciation fund, and paid £500 a year into it for five years until it amounted to £2500. They did not hand over all the profits to the Council; and the result was that, when they set about the reconstruction in 1891, there was a very considerable margin to the credit of the profit and loss (net revenue) account. During the time the undertaking had been in their possession, since 1881, they had, after paying interest, income-tax, and repairs and maintenance of works, made a profit of £40,010. They had reduced the price of gas 6d. per 1000 cubic feet, abolished gas-meter rents, put in all services free; and there was a sum of £3984 still to the credit of the profit and loss account. A discussion followed, and ultimately the recommendation was adopted.

Swansea Gas Company.—The annual meeting of this Company was held a few days since. The Directors reported that the receipts amounted to £22,018; and the expenses to £15,864—yielding a gross balance of £6154 to be carried to the profit and loss account, and making the amount at its credit, £9510. After the payment of interest on debentures, £806, and placing £200 to the depreciation fund for leasehold cottages, there remained a profit of £8504. The Directors recommended the declaration of the statutory dividends of 10, 7½, and 7 per cent. per annum for the half year ending Dec. 31, leaving £3454 to be carried forward. The Chairman (Mr. T. Travers Wood), moving the adoption of the report, said that, notwithstanding the depressing circumstances of bad trade, and the fact that many works had been closed for several months, the consumption of gas had been maintained, though not increased. This had, however, no doubt partly resulted from the continued use and increase of incandescent burners, the number of which was ascertained to have reached 6800 on Jan. 1. Turning to the working expenses, he remarked that they had been very satisfactory; and a decrease in tonnage and cost of coal had resulted. As to the residuals, sulphate of ammonia had only realized £7 10s. a ton, as against £10 and £12 in past years. The make of coke had also been reduced during the past season, in consequence of the working of the carburetted water-gas plant. The report was adopted; and votes of thanks were passed to the Chairman and Directors and the Manager (Mr. Thornton Andrews).

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The winter is over and gone; and the gas manager, free from the cares and anxieties of the dark season, once more is heard in the land. This week two gatherings of gas managers have taken place—the one the Informal Meeting in Glasgow, and the other the half-yearly meeting of the Waverley Association at Haddington. Each meeting possesses characteristics which fit it for the sphere in which it exists. The "Informal" is a meeting at which the trammels of formality are reduced to about the smallest dimensions; and the proceedings are of the free and easy order, which finds favour with less prominent managers. The Waverley meeting is distinguished as being the oldest of all such meetings. The one held this week was the 72nd. The North British Association, which is the next oldest, have held 35 annual meetings. There is not much difference in time between them; but it seems to be established, beyond doubt, that the Waverley is the "granny" of the Associations.

In his circular calling the meeting, Mr. James M'Gilchrist said that questions affecting the industry would be submitted for discussion. As a matter of fact, Mr. W. Smith (Ayr), the Chairman, submitted two subjects—the electric light in Ayr, and unaccounted-for gas. It is impossible to have a profitable discussion upon more than one point at a time; and it was the second subject which the meeting settled down upon. The practical element thus asserted itself; and I cannot help drawing the distinction, favourably, between this Informal meeting choosing one of two subjects and thrashing it out; and the lamentable occurrence which often happens at other gatherings where, a single subject having been introduced with all due formality, someone in the course of the discussion throws it off the rails by bringing forward fresh problems. That was a commendable feature of this year's meeting, due perhaps, to the tact with which Mr. Smith managed it. From another point of view, the meeting deserves to be encouraged. There seems to be a growing disposition on the part of those in the higher ranks of gas management, to abstain from attending the meeting. But their absence, though it may deprive the gathering of prestige, I look upon as an actual gain, because it gives opportunity for managers of the smaller works to speak out. One of the chief purposes of the meeting, I take to be to enable anyone who may have had something unusual in his experience during the winter to tell it for the benefit of others, and to get advice for himself upon it. Now the presence of a big man in the meeting would not encourage a manager of a small works to communicate anything he might have on his mind. For one thing, the small manager would most likely think that his experience was too trifling to be mentioned in such company; and, for another, the big man would probably take up time narrating his experiences, which would not be of much use to the small men. In this sense the Informal, in the position of a secondary meeting of managers, is of much service; and it should therefore be encouraged on the lines into which it seems to have moved of late.

For me to enter upon a consideration of Mr. Smith's address, would be out of the question, seeing that so many theories were given for the loss of gas. Probably unaccounted-for gas is due to all of the theories combined—one predominating in one place, and another in another. But Mr. Smith made a suggestion of a means of ascertaining whether gas was lost by condensation or by shrinkage of bulk by reason of the fall in temperature, upon which I would like to repeat—I have mentioned it before—that the late Mr. Linton, of Leith, clearly established that there was a very great loss of gas from this cause. In his evidence in the Falkirk arbitration, Mr. Linton said: "When I went to Leith, about 27 years ago, the leakage was 22 per cent. So much in those days was accepted as being inevitable—the average thing to have. I did not quite accept this; and I got the permission of the Directors to go into a thorough overhaul of all the pipes and services, and also of the meters, with the result that the figure at which we arrived was 5·9 per cent. But I went further, because I wished to analyze, if I could, what the 5·9 per cent. amounted to—whether it was really leakage, or whether there was something else in it. I had thermometers put all over the town in the mains; and they were read three times a day. I kept this up for three years; my purpose being to see how far the shrinkage of the bulk of gas accounted for it. The result was that, checking the gas as it was being registered at the works, we found it to be from 55° to 60° of temperature. I found that the average temperature at which it was being measured through the consumers' meters, on leaving the mains, was only about from 45° to 53° of temperature. This was taking into account what the temperature of the gas was during the winter, in the cold weather. The result was that there was a reduction of about 15° of temperature between the works and the consumers' meters, which means 3 per cent.; so that I arrived at the result that about 3 per cent. was really shrinkage in bulk, and the other 2·9 per cent. was leakage." Mr. Linton's testimony fixes the proportion of shrinkage in Leith; and though it may vary according to the climate—as, for instance, one would expect a greater shrinkage in Thurso than in Dumfries—yet, regarded generally, the amount of shrinkage may be taken as being about 3 per cent. That leakage from all the other possible causes could be reduced to 2·9 per cent., shows what can be done by attention to plant. Mr. Carlow's experience at Arbroath, in this connection, is worthy of consideration. He has reduced the leakage there from 16½ to 6¾ per cent. If, in his case, 3 per cent. is due to shrinkage in bulk, a certain further proportion will be owing to the high pressure which is necessary on account of the gas-works standing at a high level; and if there be a further proportion of condensed water or naphthalene, there is not much left which can be due to actual escape of gas. The results obtained in Leith and Arbroath might very profitably be taken to heart by every gas manager, because what was attained in these places can be realized elsewhere. It was mentioned that in Glasgow as much gas was lost as would supply a town of the size of Paisley. I have looked into this; and find that about 400 million cubic feet of gas is lost every year in Glasgow. This represents a loss of revenue to the amount of £45,000 a year. If the proportion arrived at in Leith be applied, there is found to be lost through leakage about £20,000, and by shrinkage a little more. Now, if £20,000 a year more than at present were expended upon improving the distribution plant, in the course of a year or two the gain would be enormous. I give this as an instance of what can be done. Individual managers may

calculate what the benefit would be to themselves of paying special attention to plant.

The presentations to Mr. and Mrs. Carlow brought out the largest attendance which has ever been experienced at an Informal meeting. Apart from the value to him, moral, intellectual, intrinsic, or otherwise—and in all these respects the gifts must possess great value in his eyes—Mr. Carlow must feel gratified at the mark of his popularity which was testified to by the record attendance. There were also present at the ceremony the Provost and three ex-Provosts of the burgh of Arbroath; and this circumstance, apart from the very kind remarks these gentlemen made regarding him, must have filled Mr. Carlow's heart with joy. He might well say that it was a red-letter day in their lives. It has been given to few, in my experience, to receive at the same time a testimonial from his fellows and the encomiums of his employers. And I am sure that no one grudges Mr. and Mrs. Carlow any of the happiness which was theirs. Mr. Carlow's secretarial work is always up to date; and his unfailing cheerfulness in the discharge of his duties makes him an invaluable servant to the Association. The Association are indebted to him for the healthy condition of their finances. They are, in fact, fortunate in having a Secretary who is so attentive to their interests.

Turning to the Waverley Association meeting, the first remark which I feel called upon to make is that, with such a lovely day as Thursday was, the outing to Haddington was one long experience of delight. The Waverley meeting is also to a large extent an informal one. The members are nearly all of one class; and they are thus in the fortunate position that whatever affects or interests one, is of the same moment to all. The Haddington meeting will be memorable on account of the presence of Mr. James Robb, who was for 42 years Manager of the Haddington Gas Company's works, and is now living in retirement. Mr. Robb is within a few months of ninety years of age, and is still hale and active. He wears the President's Medal of the North British Association, presented to him at Perth in 1880, and of which he is very proud. He was aptly described as "The Grand Old Man" of the Association. His successor, Mr. W. Blair, who presided at the meeting, gave some interesting reminiscences at the dinner. Speaking of himself, he said that when he was a boy, his grandfather, his father, and five uncles, were all in high positions in connection with gas making. His grandfather began the making of gas in 1818. He was Manager of the Johnstone Gas-Works, near Paisley. There were no railways in those days; and Mr. Robb would sometimes walk from Haddington to Johnstone to see his grandfather. It was at Johnstone that he first saw a gas-exhauster. It was worked by a jack in the chimney. If Johnstone were not the first place where a fire-clay retort was made, it was among the first; for his grandfather made one with his own hands, and it was baked in the setting itself. The fire-clay was lying ready to hand, in the material they excavated for the formation of a tank.

On arriving in Haddington, the visitors were first taken through the gas-works, which were found to be commodious and apparently well situated; but at the meeting Mr. Blair gave an account of the site which led to a modification of first impressions. The retort-house is, on three sides, 10 feet below the surface of the ground; and there are numerous springs of water on the site. Beneath the bench in the retort-house itself, a little over 2 feet below the floor, there is a well discharging from 80 to 100 gallons of water per 24 hours; a stone-built culvert runs through the entire length of the retort-house, about 4 feet down; and a line of clay also runs along the middle of the floor. It surely must have been by accident that such an unsuitable place was selected for a retort-house. But Mr. Blair overcame the difficulties of the site by laying a concrete floor, which had given every satisfaction to him. On account of the presence of the water, it was impossible to go deep enough for the introduction of a regenerative system of firing; and so he adopted a system which he called a generative one. At first he had not a steam-boiler; and he told of an ingenious arrangement, whereby he got steam from a water-pipe which he introduced into the flue. This worked admirably; but, probably from non-attention, the pipe got burned away, and he had since put in a steam-boiler. The discussion which followed Mr. Blair's presidential address was conversational in its character, and was not prolonged beyond the point where interest would have ceased. There was a very enjoyable drive in the afternoon to Gosford, the seat of the Earl of Wemyss, where, through the forethought of Mr. Rutherford, the newly-elected President, the members inspected the mansion-house.

By the favour of the Secretary of the Waverley Association (Mr. J. D. Smith, of Selkirk), I am able to reproduce a document which clears up the darkness in which the origin of the Waverley Association is enshrouded. It also enables me at the same time to do fuller justice to the memory of the late Mr. W. Robson (Mr. Smith's predecessor at Selkirk), than I was able to do in the "JOURNAL" for the 30th ult. The document is embodied in the minute-book of the Association, and is entitled: "Statement prepared by Mr. Robson with reference to the formation of the Waverley Association." It is dated April 25, 1892. I give it in full: "Gas-Works, Selkirk. Statement of Mr. W. Robson, Gas Manager, Selkirk, as to the origin of the Waverley Association of Gas Managers. The Waverley Association was commenced at Kelso, Aug. 5, 1861. During the month of July previous to that, I wrote to all the gas managers nearly, south of the Forth, to meet at Kelso on the 5th of August; and we put Mr. Clazy, Kelso, in the chair. Mr. Adamson, then in Galashiels, now in the Aidrie Iron-Works, we made Secretary; and he took minutes of all that was done. One of the resolutions was to advertise in the papers to all gas managers in Scotland to meet in Edinburgh in the month of April, 1862, to form one general Association for Scotland. Mr. Adamson having been Manager at the Leven Gas-Works before he got Galashiels, was intimate with Mr. W. Mackenzie at Dunfermline, then Manager at Cupar. They had been corresponding; and Mr. Adamson had written to Mr. Mackenzie what had been done at Kelso. Through this, Mackenzie had apparently warned some of the Fife and Clackmannan managers; and they met at Leven on Jan. 24, 1862, and formed an Association, called the Fife, Kinross, Perth, and Forfar Association of Gas Managers. In the month of April, we met in Edinburgh, and formed the Scottish Association of Gas Managers. I remember both Mackenzie, of Cupar, and Lowden, of Leven, attended. A resolution was proposed that the annual fee to be paid was to be 2s. 6d. Mackenzie proposed 2s.; and Lowden seconded him. The 2s. 6d. was carried; those two only voting for 2s. So those two Fife gentlemen did not join the Association, or ever come back again. In a pamphlet sent out by the North British Association, you will see that they had Lowden down as first Chairman

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 824).

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	9 Apl.	10½	Alliance & Dublin 10 p. c.	23–25*	..	4 4 0
100,000	10	"	7½	Do. 7 p. c.	17½–18½*	+½	4 1 1
300,000	100	2 Jan.	5	Australian (Sydney) 5% Deb.	108–111	..	4 10 11
200,000	10	29 Oct.	5	Belgrano (B. Ayres), Limited	9½–10	..	5 0 0
100,000	Stck.	30 Dec.	5	Do. 5 p. c. Deb. Stk	102–105	..	4 15 3
200,000	5	12 Nov.	6½	Bombay, Limited	6½–7½	..	4 6 8
40,000	5	"	6½	Do. New, £4 paid	5–6	..	4 6 8
380,000	Stck.	26 Feb.	12	Brentford Consolidated	285–293	..	4 2 9
240,000	"	"	9	Do. New	223–228	..	3 18 7
50,000	"	"	5	Do. 5 p. c. Pref.	138–143	..	3 9 11
159,375	"	11 Dec.	4	Do. 4 p. c. Deb. Stock.	130–134	..	2 19 9
220,000	Stck.	25 Mar.	11½	Brighton & Hove Original	270–275	..	4 3 7
208,820	"	"	8½	Do. A Ord. Stk.	197–202	..	4 4 2
933,500	Stck.	26 Feb.	5	Bristol, 5 p.c. max.	130–135	..	3 14 1
420,000	20	26 Mar.	11½	British	56½–57½	..	3 18 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	23–25	..	4 12 0
71,000	10	"	8½	Do. 7 p. c.	18–20	..	4 5 0
500,000	10	15 Oct.	6	Buenos Ayres (New) Limited	9½–10	..	6 0 0
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	101–103	..	5 16 6
150,000	20	26 Feb.	8½	Cagliari, Limited	29–31	..	5 6 5
100,000	10	30 Sept.	6	Cape Town & District, Ltd.	16–17	+½	3 10 7
50,000	50	3 Nov.	6	Do. 6 p. c. 1st Mort.	57–59	..	5 1 8
550,000	Stck.	9 Apl.	13½	Commercial Old Stock	340–345*	+2½	3 18 3
165,000	"	"	10½	Do. New do.	252–257*	+2½	4 1 8
165,000	"	11 Dec.	4½	Do. 4½ p. c. Deb. do.	150–155	..	2 18 0
800,000	Stck.	30 Dec.	13	Continental Union, Limited.	255–260	..	5 0 0
200,000	"	"	10	Do. 7 p. c. Pref.	215–220	..	4 10 11
51,600	Stck.	26 Feb.	14	Croydon Com'cial A 10 p. c.	317–322	+2	4 6 11
163,400	"	"	11	Do. B 7 p. c.	252–257	+2	4 5 7
535,000	Stck.	26 Feb.	5½	Crystal Palace Ord. 5 p. c. Stk	140–144	..	3 12 11
60,900	"	"	5	Do. 5 p. c. Pref.	140–143	..	3 9 11
486,090	10	29 Jan.	11	European, Limited	24½–25½	..	4 6 3
354,760	10	"	11	Do. £7 10s. paid	17½–18½	..	4 9 3
5,836,590	Stck.	12 Feb.	12¾	Gaslight & Coke, A, Ordinary	300–305	−2	4 3 6
100,000	"	"	4	Do. B, 4 p. c. max.	110–114	..	3 10 2
665,000	"	"	10	Do. C, D, & E, 10 p.c. Pf.	308–313	..	3 3 10
30,000	"	"	5	Do. F, 5 p. c. Prf.	145–150	..	3 6 8
60,000	"	"	7½	Do. G, 7½ p. c. do.	210–215	..	3 9 9
1,300,000	"	"	7	Do. H, 7 p. c. max.	207–212	..	3 6 0
463,000	"	"	10	Do. J, 10 p. c. Prf.	307–312	..	3 4 1
476,000	"	"	6	Do. K, 6 p. c. Prf.	182–187	+2	3 4 2
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	137–142	..	2 16 4
294,850	"	"	4½	Do. 4½ p. c. do.	150–155	..	2 18 1
908,000	"	"	6	Do. 6 p. c. do.	207–212	..	2 16 7
70,000	10	29 Oct.	6	Hongkong & China, Limited	12–13	..	4 12 4
3,800,000	Stck.	12 Nov.	12	Imperial Continental	206–211	+1	5 13 9
376,400	100	1 Feb.	4	Do. 4 p. c. Debs. Red.	102–103	+1	3 17 8
473,600	Stck.	12 Feb.	3½	Do. 3½ p. c. Deb. Stk	104–107	..	3 5 5
75,000	5	11 Dec.	6	Malta & Mediterranean, Ltd.	5¾–6¼	..	4 16 2
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	111–113	..	4 8 6
250,000	100	"	4½	Do. 4½ p. c. Debs.	107–109	..	4 2 7
541,920	20	12 Nov.	5	Monte Video, Limited	15–16	..	6 5 0
150,000	5	26 Nov.	8	Oriental, Limited	8½–9	..	4 8 11
135,000	5	"	8	Do. New, £4 10s. paid	7½–8	..	4 10 0
15,000	5	"	8	Do. do. 1879, £1 paid	1½–2	..	4 0 0
60,000	5	26 Mar.	7	Ottoman, Limited	5–5½	..	6 7 3
420,000	100	2 Nov.	6	People's Gas } 1st Mtg. Bds.	104–109	..	5 10 1
500,000	100	1 Dec.	6	of Chicago } 2nd Do.	104–109	..	5 10 1
250,000	10	30 Sept.	10	San Paulo, Limited	13½–14½	..	6 18 0
5,475,000	Stck.	26 Feb.	5½	South Metrop., 4 p.c. Ord.	141–144	−1	3 12 11
850,000	"	14 Jan.	5	Do. 5 p. c. Deb. Stk.	173–177	..	2 16 6
60,000	Stck.	12 Mar.	11½	Tottenham & Edmonton, A	275–285	..	4 0 10
60,000	"	"	8½	Do. B	190–200	..	4 5 0
182,380	10	30 Dec.	10	Tuscan, Limited	14–15	..	6 13 4
149,900	10	2 Jan.	5	Do. 5 p. c. Debs. Red.	101–103	..	4 17 1
				WATER COMPANIES.			
746,159	Stck.	30 Dec.	10½	Chelsea, Ordinary	333–338	..	3 2 2
150,000	"	"	5	Do. 5 p. c. Pref.	175–180	..	2 15 6
160,000	"	"	4½	Do. 4½ p. c. Pref. Stk., 1875	158–162	..	2 15 6
175,785	"	26 Mar.	4½	Do. 4½ p. c. Deb. Stock	160–165	..	2 14 6
1,720,560	Stck.	9 Apl.	7	East London, Ordinary	220–225*	−1½	3 2 2
554,740	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	164–169	+2	2 13 4
392,000	"	"	3	Do. 3 p. c. Deb. Stk.	106–108	..	2 15 7
700,000	50	11 Dec.	7½	Grand Junction, 10 p.c. max.	112–117	..	3 4 1
295,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	148–153	..	2 12 4
708,000	Stck.	12 Feb.	12	Kent	340–345	..	3 9 7
160,000	"	"	7	Do. New, 7 p. c. max.	212–217	..	3 4 6
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	272–277	..	3 8 7
406,200	100	"	7½	Do. 7½ p. c. max.	222–227	..	3 6 1
350,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	147–150	..	2 13 4
500,000	100	12 Feb.	13	New River, New Shares	420–425	..	3 1 1
1,000,000	Stck.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	152–155	..	2 11 7
902,300	Stck.	30 Dec.	6	S'thwk & V'xhall, Ordinary	155–160	..	3 15 0
126,500	100	"	6	Do. Do. 7½ p. c. Max.	150–155	..	3 17 5
489,200	Stck.	"	5	Do. Do. 5 p. c. Pref.	175–180	..	2 15 7
1,019,585	"	9 Apl.	4	Do. 4 p. c. A Deb. Stk.	145–148*	..	2 14 2
1,155,066	Stck.	11 Dec.	10	West Middlesex	310–315	..	3 3 6
200,000	"	"	4½	Do. 4½ p. c. Deb. Stk.	163–168	..	2 13 7

*Ex div.

of that Association. He might be the first Chairman of the Fife, &c., Association, but never of the Scottish Association. Mr. Clazy was put in as first President; and Mr. Adamson as Secretary. The Scottish Association swallowed up the Fife, &c., Association, and then became the North British Association. The minute-book of the Scottish Association will show all I have written. The Waverley Association has always continued since the Kelso meeting." This is a clear statement, and is worth having on record. I understand that the minute-book of the first meeting at Kelso cannot be produced, as it was lost by Mr. Adamson about the time of the meeting in Edinburgh in April, 1862.

A philanthropic Company, known by the name of Edmundsons, Limited, engineers and electricians, of Westminster, have turned their bowels of compassion on the community of Montrose, who have been content as yet to live with no better artificial light than they can get from gas. At a meeting of the Police Commissioners of the burgh on Monday, a letter from the Company was read, in which they stated that they were forming local companies, the advantage of which was that the Corporation, or people in the town, could invest their money in the concern, and thus support it, while at the same time being benefited by it. They undertook to find the balance of the money required to put down the plant; and it would be in the option of the Corporation to buy the works at any time after ten years, on paying the cost, together with 15 per cent. They also undertook to supply light for the public lamps at 4d. per unit. The proposal was favourably received; and a Committee was appointed to make investigations on the subject. I would recommend them to look at the matter in this light: Suppose an installation were to cost £10,000, they are to pay this sum, with 15 per cent., at the end of ten years, which would make the price £11,500. There appears to be no allowance for depreciation in the price. This should be taken at 10 per cent., or £1000; so that the community would be required to pay £11,500 for works which would then be only worth £9500. In other words, the people of Montrose, having paid interest on the outlay all along, would require to pay the full capital and 20 per cent. more, before they could call the works their own. The generosity of the offer is thus not so very apparent after all.

There seems to have been an exhibition of gas appliances at Alloa last week, of which I have no notice. I observe, however, that an Alloa newspaper Editor, referring to it, says: "It is gratifying to learn, from the interesting statement made by Bailie Arrol, the indefatigable Convener of the Committee, that, notwithstanding other agencies at work in the burgh, the consumption of gas continues steadily to increase; and that, to meet the constantly increasing demand, it has been found necessary to greatly extend the present works. Whatever it may be with our near neighbours in Stirling, where the proposal to acquire the gas-works is causing such a ferment, there can be no doubt whatever that the municipalization of the gas in Alloa has been an unqualified success, and a distinct acquisition to the ratepayers. Besides being infinitely better in quality, the price is almost half what it was when the works were acquired by the Commissioners; while the consumption has been more than trebled during the last twenty years. All this goes to prove most conclusively that, whatever developments there may be in connection with the electric light, there is still a great future in store for gas, both as an illuminant and for cooking and heating appliances."

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 10.

Sulphate of Ammonia.—A very quiet market has again to be recorded, with a further drop in values; the closing quotations being £7 12s. 6d. per ton f.o.b. Leith, and £7 15s. per ton f.o.b. Hull and Liverpool. Direct export orders continue scarce; and dealers are still buying sparingly, so that demand has been scarcely equal to supply. The forward position is mainly in possession of speculators, who are offering abroad for May-June delivery at something under spot prices, and July-September at about £8 per ton delivered f.o.b. Exports show an increase of above 5000 tons, as compared with those during the same period of 1896; and home consumption will probably exhibit an increase at an even greater ratio.

Nitrate of Soda.—Deliveries during the past week or two have been on a satisfactory scale. But supplies are ample to meet all likely demands; and prices are only just maintained. Spot quotations remain 8s. per cwt. for good up to 8s. 3d. per cwt. for refined quality.

LONDON, *April* 10.

Tar Products.—There is more inquiry for benzols; and 90 per cent. after being neglected, is now looking up again. There is an undoubted dearth of benzols in any form—crude or refined—in manufacturers' hands. It has been known for some time that consumers are working from hand to mouth; and pressing for deliveries on high-priced contracts. Under these circumstances, it seems as though benzol may maintain its position for the ensuing summer; and the production from the new coke-ovens, which has been so much magnified, has been entirely discounted. The said new production, however, was sold at the end of last year for a long period forward. Anthracene has excited a good deal of attention; and the lower prices quoted by the Committee and outside producers are likely to bring more regular business in the article. Carbolic acid keeps firm, and solvent and heavy naphthas are wanted. Creosote, naphthalene oils, and pitch are all weak and unsaleable.

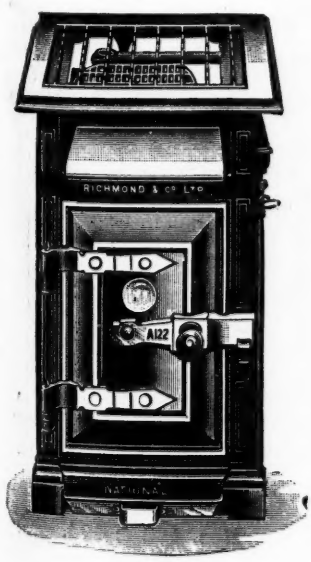
Market prices are as follows: Tar, 15s. to 20s. Pitch, 20s. to 22s. 6d. Benzol, 90 per cent., 2s. 5d.; 50 per cent., 2s. 4d. Toluol, 2s. 3d. Solvent naphtha, 1s. 7½d. Crude, 30 per cent. naphtha, 1s. 1d. Creosote, 1½d.; liquid, 1½d. Heavy oils, 35s. Carbolic acid, 2s. 6d. Naphthalene, 55s.; drained salts, 25s. Anthracene, "A," 6½d. to 7½d.; "B," 5d. to 6d.

Sulphate of Ammonia shows no change for the better, notwithstanding the very considerable business being done in the article both for home consumption as well as for shipment. There is a good market at prices ranging between £7 12s. 6d. and £7 16s. 3d., less 3½ per cent., at all ports, according to quality and conditions.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The usual gas coal season is now commencing; and a fair number of inquiries are already on the market. So far as can be gathered from the few quotations which have up to the



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WARRINGTON, STRATFORD, & LONDON.

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Prepayment Meter Cooker.

VERY STRONG,

OF GOOD APPEARANCE,

AND WELL PROPORTIONED.

ALL BURNERS REMOVABLE AND SUPPLIED WITH WHITE ENAMELLED CROWN-PLATE.

No. 122A . . . . 36s.

present been sent out, colliery proprietors are endeavouring to secure some advance upon the very low figures which were being accepted last year. Of course, nothing has as yet been actually put through in the way of contracts, to establish any real basis as to the prices that are likely to rule; but generally there would seem to be an endeavour to get an advance of 3d. to 6d. per ton upon last season's rates. One ground put forward for holding out for higher prices for gas coal is that the competition of gas stoves and ranges is so seriously interfering with requirements for house-fire qualities of coal that rates for these have to give way; and therefore colliery proprietors are being driven to seek some return in the shape of better prices for gas coal. How far this policy can be carried out, remains to be seen. Certainly the outlook in the round coal trade is not very encouraging for maintaining advanced prices during the ensuing season, as supplies promise to be plentiful, and already there is a good deal of competition and cutting down upon list rates to secure business. The disputes in the engineering trades and the unsettled tone in the iron market, necessarily unfavourably affect the demand for common round coal; and supplies are plentiful, with prices weak. Engine fuel is becoming scarcer in the market; and there is rather a hardening tendency in the better qualities. But the average figures remain unchanged. At the pit mouth, best Wigan Arley does not average more than 10s. per ton; seconds Arley and Pemberton four-feet, 8s. to 8s. 6d.; steam and forge coal, 5s. 9d. to 6s. 3d.; and engine fuel, from 3s. to 3s. 6d. for common, up to 4s. 9d. for best sorts. The demand for shipment continues slow, with ordinary steam coal, delivered at the Mersey ports, still averaging about 7s. 6d. to 7s. 9d. per ton.

Northern Coal Trade.—There has been more activity in the coal trade in the past few days; and as the opening of Baltic ports is now close at hand, it must be expected that there will be an increase of the exports, especially of steam coals. Best steam coals are now higher in price in consequence of the increased demand; the general quotation being from 8s. 3d. to 8s. 6d. per ton f.o.b. Second qualities are about 9d. per ton less; and steam smalls, from 3s. 9d. to 4s. In gas coals there is a rather fuller export; but the home consumption is falling rapidly now, as is to be expected with the lengthening days. Best Durham gas coals are quoted generally at 6s. 6d. to 7s. per ton f.o.b., though one or two producers ask rather higher prices. There is no alteration in the price of gas coke.

Scotch Coal Trade.—It cannot be said that any change can be reported in the coal market. Forward orders are still difficult to get. Gas coal contracts are being taken up; and the prices ruling are a perceptible shade higher than those which obtained last year. The output of coal is larger than the demand, with the result that stocks are beginning to accumulate. The opening of the Baltic ports should, however, clear some of them off. The prices quoted are: Main, 6s. 6d. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s. 3d.; and splint, 6s. 9d. to 7s. The shipments for the week amounted to 137,076 tons—an increase over the preceding week of 7424 tons, but a decrease on the corresponding week of last year of 29,734 tons. For the year to date, the total shipments have amounted to 1,680,330 tons—an increase over last year of 65,369 tons.

Projected New Gas-Works for Blackpool.—At the last meeting of the Blackpool Town Council, it was agreed that the Gas Manager (Mr. J. Chew) is to prepare plans for the erection of new gas-works on the east side of the railway, near the present works.

Fylde Water-Works Company.—The half-yearly report states that the balance of profit is £11,348, which, with the amount brought forward from the last account, gives a total of £18,566. The Directors recommend dividends at the rate of 4, 10, and 7 per cent. on the various classes of stock—leaving a balance of about £8756 to be carried forward.

Incandescent Gas Lighting at Harwich.—For some years past, Harwich has been lighted by oil, in consequence of a disagreement with the Gas Company as to price. But incandescent gas lighting has found favour in the eyes of the majority of the town councillors; and last Thursday they adopted a report which will be the means of considerably altering the aspect of the streets at night. The oil-lamps are to be displaced by 206 incandescent gas-lights; and the total annual cost will be about £689. A contract is to be entered into with the Gas Company for a term of seven years.

Southborough Water Supply.—At a recent meeting of the Southborough District Council, a letter was read from the Local Government Board in respect of the application of the Council for sanction to borrow £2000 for works of water supply. The Board have complied with the application so far as relates to the sum of £900 required for defraying the cost of sinking the present tube-well; and they allow five years for repayment. The Board will not, however, sanction a loan in respect of £500 expended on the first well, inasmuch as the work proved a failure; and the remaining £600 of the £2000 asked for will be the subject of further consideration when the Board are assured that the new well has been found to yield a sufficient supply of good water. The Council do not know what steps to take in respect of the expenses incurred in the first boring operations; and a Committee has been appointed to deal with the difficulty.

The Use of Gas Cooking-Stoves in Scarborough.—The annual exhibition of modern gas cooking and heating appliances held under the auspices of the Scarborough Gas Company was opened in the Town Hall last Tuesday afternoon by the ex-Mayor (Alderman H. M. Cross, J.P.). Exhibits were shown from all the leading firms; their arrangement being carried out under the supervision of the Company's Engineer and Manager (Mr. J. Holliday). In the course of his remarks when performing the opening ceremony, the ex-Mayor laid special stress upon the value of a knowledge of cookery, and referred to the satisfactory results which had attended the teaching of this useful art in the evening classes started in connection with the elementary schools in the town. With regard to the work of the Gas Company in the matter of stimulating the use of gas for culinary operations, he gave some figures which showed how successful had been their efforts. In 1890, they had out on hire 451 cookers; three years later, the number had increased to 703; while last year it was 1113. During the exhibition, which closed on Friday, Miss Thwaites gave a series of cookery lectures, which were much appreciated.

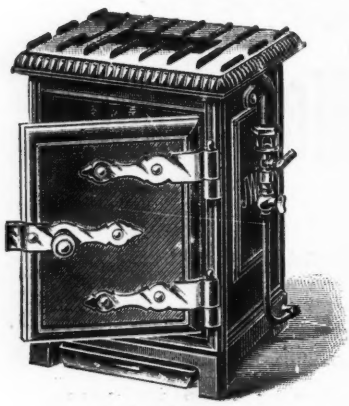
NEW "PENNY-IN-THE-SLOT" COOKERS

Arranged specially for Prepayment Meters.

Adopted by all PRINCIPAL LONDON and PROVINCIAL GAS COMPANIES.

All Parts Rapidly and Cheaply Replaced.

Very Simple and Strong.



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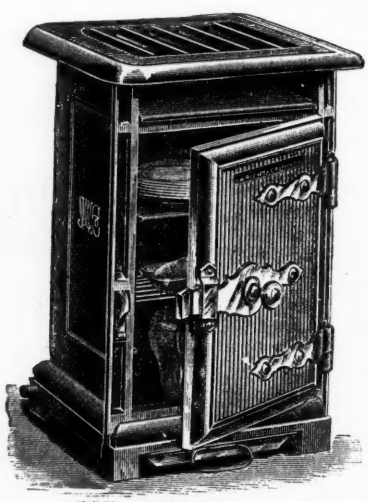


No. 402.

Nos. 403 & 404.

JOHN WRIGHT & CO., LIMITED,

ESSEX WORKS, BIRMINGHAM; and 105, CHEAPSIDE, LONDON.

New Water-Works for Rochford.—The Rochford (Essex) District Council have resolved to expend £1000 in acquiring land for the construction of new water-works.

New Joint-Stock Companies.—The Water Motor and Automatic Liquid Elevator Company, Limited, has been registered with a capital of £25,000, in £10 shares, to carry on the business of manufacturers of pumps, water motors, automatic liquid elevators, and other machinery. The Mid-Kent Coal Syndicate, Limited, with a capital of £12,000, in £1 shares, has been formed to search for coal in Kent and elsewhere, and to carry on business as colliery proprietors, coke manufacturers, coal merchants, ironmasters, &c.

Great Reduction in the Waste of Water at Salisbury.—The Corporation of Salisbury having, by legal and other action, convinced the inhabitants of the city that they do not intend to tolerate any longer the excessive waste of water that has been going on through defective fittings, considerable activity has been shown in effecting repairs and alterations. In consequence, the consumption of water has been reduced, in six weeks, from 58 gallons per head per day to 40 gallons. As a result, the officials have been able to give a constant supply of water with the old pumps and engine with full pressure from the reservoir during the day, and a reduced pressure during the night.

Last Tuesday, an exhibition of gas appliances by Messrs. R. and A. Main, of Glasgow, was opened in the City Hall, Perth, under the auspices of the Perth Gas Commissioners. This is the fourth exhibition which the Commissioners have promoted.

Messrs. John Wright and Co. are, by arrangement with the Bristol Gas Company, exhibiting specimens of their domestic gas stoves and appliances in the Colston Hall, Bristol. The exhibition (which closes to-morrow) has been made attractive by the cookery demonstrations of Miss M. Ball.

The Highbridge Gas Company are about to remodel their works at a cost of about £2000. Several firms were invited to submit designs and specifications for the necessary plant; but those prepared by Messrs. Cockey and Sons, Limited, of Frome, have been adopted, and the work has been placed in their hands.

Mr. C. Billington, jun., of Stoke-upon-Trent, whose device for facilitating the scurfing of gas-retorts was noticed in our "Register of Patents" last week, has made arrangements with Mr. John Ruscoe, of Hyde, Cheshire, for the latter to be the sole maker of the appliance, which, we understand, has been tried with very satisfactory results by Mr. H. Peaty, at the Burslem Gas-Works.

GWYNNE & BEALE'S
PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 65,095.

GWYNNE & CO.,

HYDRAULIC AND GAS ENGINEERS,

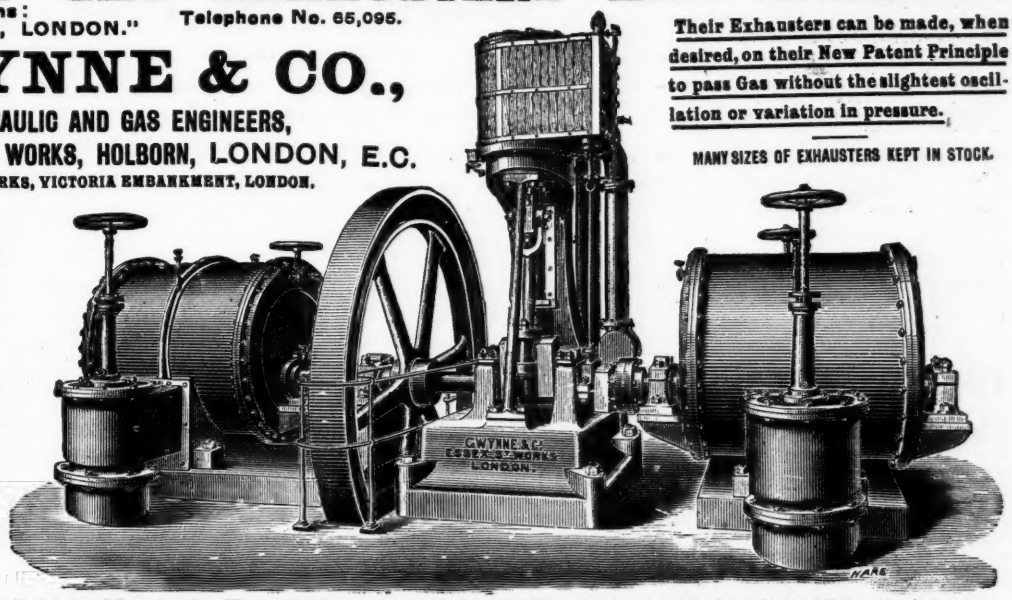
BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

They have completed Exhausters to the extent of 22,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.



Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.

Catalogues and Testimonials sent on application.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

JOHN WM. O'NEILL, Managing Director, Palmerston Buildings, Old Broad Street, London, E.C.

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WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. in use in most Continental Gas-Works, and in more than 300 British Gas-Works.

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Telegrams: "Volcanism, London."

AMMONIACAL LIQUOR wanted. BROTHERTON AND CO., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR wanted. BROTHERTON AND CO., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE wanted. BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHURIC ACID for Sale. BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BROTHERTON & CO. Offices: Commercial Buildings, LEEDS. Correspondence invited.

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."
[For Illustrated Advertisement, see April 6, p. 804.]

SADLER & Co., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making, Kerosene, &c.
Correspondence invited.
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ALEX. P. KER, C.E., Consulting Gas Engineer, Hunton Road, Gravelly Hill, Birmingham, 25 Years Assistant Engineer and Manager of Works to the Corporation of Birmingham and their predecessors, MAY BE CONSULTED on all matters connected with GAS ENGINEERING, including Valuations, Alterations, Additions and Extensions, &c. REPORTS upon EXISTING WORKS and IN PROGRESS. EXAMINATIONS OF GAS for ILLUMINATING POWER and IMPURITIES conducted. Plans, Specifications, and Estimates prepared.

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OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
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Telegrams: "BOGORE, LONDON."

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c. CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special Attention to Repairs.
Before placing Orders, please write for Estimate.

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JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, NEWTON GRANGE, NEWBATTLE, DALKEITH, } SCOTLAND.

TO GAS AND WATER OFFICIALS.

SPECIAL and Favourable Terms for CYCLES are offered. The very best "up-to-date" Cycle at a reasonable Cost. "Dunlop" Tyres, Weldless Tube throughout, "Westwood" Rims, "Brook's" Saddle, "Perry's" or "Renold's" Chain, &c. The whole combining to make as fine a Machine as is possible to be made. Satisfaction guaranteed. Send at once for Catalogue post free.
MELROSE CYCLE COMPANY, COVENTRY.

EASTER HOLIDAYS.

NOTICE TO ADVERTISERS.—In consequence of the **EASTER HOLIDAYS**, orders with respect to **ADVERTISEMENTS** should be received at the Office *not later* than **THE FIRST POST ON SATURDAY NEXT.**

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

WANTED, a Situation as Inspector (good Fitter, and willing to be generally useful to Manager), or to take charge of Small Works.
Address No. 2823, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

RE-ENGAGEMENT wanted by young Man (age 26) in any position of trust in a Gas-Works. Ten years' Experience. Full Honours Certificate in Gas Manufacture. Good References. Abstainer. No objection to go abroad.
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ADVERTISER (age 30), with Twelve years' Experience of Gas Apparatus generally, is desirous of REPRESENTING OLD-ESTABLISHED FIRM OF METER MAKERS, &c. Manchester District preferred.
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GAS-WORKS WORKING MANAGER.

WANTED, in a small Gas-Works supplying an increasing demand for Gas, a WORKING MANAGER having experience, and fully qualified in all the recently improved Furnaces, Retorts, and other Apparatus, including Siemens' Regenerative and other Furnaces. Must be a qualified Gas-Fitter, able to give all requisite attention to Meters, Gas-Stoves, &c.
Reply, by letter *only*, to F9, *Daily Post*, BIRMINGHAM, stating Age and Wages required. Unexceptional References must be given.

SECRETARY WANTED FOR GAS-WORKS.

WANTED, a practical and experienced Man in Gas Manufacturing, by a small Limited Company in a rising District, with a rapidly increasing Population. Must be able to conduct all the usual work of a Secretary, and have sufficient practical knowledge of Gas Making to efficiently inspect the Works, including Meters and all the necessary Apparatus, and be sufficiently informed to superintend the Property and operations of the Company.
Reply, by letter *only*, to 309 *Daily Post*, Birmingham, stating Age, past Experience, and Wages required. Unexceptional Reference necessary. A good Salary will be given to a thoroughly qualified and responsible man.

COUNTY BOROUGH OF SALFORD.

GAS ENGINEER.

THE Corporation of Salford require an experienced ENGINEER and MANAGER to take charge of the Gas-Works of the Borough.
The Gentleman appointed will be required to devote the whole of his time to the duties of his Office.
Letters of application, stating Age and Salary required, endorsed "Gas Engineer," with Testimonials as to Qualifications, to be sent to me not later than Five p.m., on Thursday, April 29, 1897.
Canvassing is strictly prohibited.

By order,
SAMUEL BROWN,
Town Clerk.

Town Hall, Salford,
April 9, 1897.

CORPORATION OF COLNE.
(GAS DEPARTMENT.)

TO BRICKLAYERS AND RETORT SETTERS.

WANTED, at the Corporation Gas-Works, a few good BRICKLAYERS and RETORT SETTERS.
Applications to be sent to the undersigned.

By order,
HY. SIMMONDS,
Engineer.

Gas-Works, Knotts Lane,
Colne, Lancs., March 31, 1897.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS.
MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.

GAS EXHAUSTERS.

OUR SPECIALITY is High-Class Gas EXHAUSTING MACHINERY. Various Sizes in Stock or Progress. Write for Estimates.
SELLERS, PICKERING, AND CO., Gas Engineers and Contractors, Ravensthorpe, YORKS.

SULPHATE OF AMMONIA SATURATORS

WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

THE Gorleston and Southtown Gas Company have a vacancy for an ARTICLED PUPIL to learn Gas Engineering.
Apply to W. PALGRAVE BROWN, Southtown, GREAT YARMOUTH.

AGENT FOR BOG ORE.

WANTED, an Agent for the Sale of BOG ORE in the United Kingdom. Good Commission paid.
Apply to No. 712, the INTERNATIONAAL ANNONCE-BUREAU, AMSTERDAM.

WANTED, by a Suburban Gas Company, a MAIN and SERVICE LAYER.
Applications, stating Age, Wages required, &c., and accompanied by Testimonials, to be addressed to No. 2834, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ALDERSHOT GAS AND WATER COMPANY.
FARNBOROUGH BRANCH.

GAS-FITTER.

WANTED, immediately, a good reliable Workman, of respectable appearance, as above. Must be well up in fixing Meters, Gas-Stoves, and Fittings (internal) in Compo. and Iron Pipe. Wages to commence with 25s. per week.
Apply, giving *copies* of References (not returnable), to SUPERINTENDENT, Gas-Works, Farnborough, HANTS.

THE Directors of the Galway Gaslight Company, Limited, will, at their Meeting to be held on Wednesday, the 21st day of April, 1897, appoint a suitable person as MANAGER of their Works.
Salary £100 per annum, with Residence on the Premises, Fuel, and Light.
Applications, accompanied by Testimonials as to character and efficiency, addressed to the presiding Chairman, will be received up to One o'clock on the day of Meeting.

By order,
J. B. HUDSON,
Secretary.

Gas Offices, Queen Street,
Galway, March 31, 1897.

SUB-INSPECTOR.

WANTED, at the Reading Gas-Works, a steady and energetic young Man, of good address, as SUB-INSPECTOR of PUBLIC and PRIVATE LIGHTING, &c. He must be a Practical Gas-Fitter, and thoroughly acquainted with Gas Cooking-Stoves, Fires, Incandescent, and other Burners, and be able to advise Consumers as to their Gas Supply generally.
Apply, in own handwriting, stating Experience, present Employment, Wages required, Age, &c., to the undersigned.

EDWARD BAKER,
Engineer and Manager.

Reading Gas-Works,
April 2, 1897.

SOWERBY BRIDGE URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

METER INSPECTOR.

WANTED, an industrious and reliable person as METER INSPECTOR. Preference will be given to one who fully understands, and is competent to repair, Dry Meters.
Applications must be sent in not later than April 26, 1897, stating Wages and Experience, with *copies* of two Testimonials, addressed to

JOHN MARSLAND,
Engineer and Manager.

Gas-Works
Sowerby Bridge.

FOR SALE, cheap—
One TELESCOPIC GASHOLDER, 32 ft. diameter, with two lifts 14 ft. deep each; Capacity, 22,500 cubic feet, with Wrought-Iron Tank complete.
One CAST-IRON SCRUBBER, 38 ft. 6 in. by 6 ft. diameter.
Two PURIFIERS, 8 feet square, complete, with 6-inch Bye-Pass Valves and Connections.
EXHAUSTERS, 5000 to 60,000 cubic feet per hour.
We would undertake to re-erect any of the above, if desired.
Photos, Particulars, and Prices of above on application to SAML. WHILE AND SONS, 60, Queen Victoria Street, LONDON, E.C.

BLUE PRINTS of all kinds in any weather. Drawings and Tracings promptly executed.
J. L. FEATHERSTONE, 21, Old Queen Street, WESTMINSTER, S.W.

ECONOMY IN PURIFICATION.

INCREASE the Efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.
References and Particulars can be obtained from the Makers—
C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP.
And J. EVERY & SON, Phœnix IRON-WORKS, LEWES.

GAS TAR and Ammoniacal Liquor Wanted.
Apply to JOSIAH HARDMAN, Milton, STAFFS.

WANTED, to purchase Gas Carbon delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.
Address, stating Price per ton and quantity, No. 2772, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Anderson's combined WASHER and SCRUBBER, with Four-Way Valve and 10-inch Connections, suitable for about 150,000 cubic feet per day.
Apply to

THOS. PRICE,
Engineer and Manager.

Gas-Works, Walton-on-Thames.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also COMPLETE WORKS equal to 7000, 20,000, 60,000 cubic feet per diem. **Inquire and compare Prices and Particulars before ordering elsewhere.**
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

FOR SALE—Six Clay ⌂-Retorts 7 ft. 9 in. full length, inside measurement 13 in. by 13 in. No Mouthpieces. In good condition.
Retorts will be put on Rail at Malling Railway Station. The Purchaser to pay carriage from Malling.
Offers invited, which must reach me by the 13th of April.

HENRY D. WILDES,
Secretary.

Gas Company, West Malling,
April 2, 1897.

WARRINGTON CORPORATION.
(GAS DEPARTMENT.)

REMOVAL OF WORKS.

FOR SALE—18-in. by 14-in. ⌂, and 15- inch and 18-inch Round, MOUTHPIECES, HYDRAULIC MAINS, ASCENSION-PIPES, FURNACE FITTINGS, EXHAUSTERS, TAR-WASHER, 18-inch CENTRE and FOUR-WAY PURIFIER VALVES, 12-inch HYDRAULIC CENTRE-VALVE, METER (12-inch Connections), ENGINES, PUMPS, &c.
Apply for Particulars to Mr. W. S. Haddock, Engineer.

FREDK. TAYLOR, Secretary.

Gas-Works, Warrington.

COMPLETE GAS PLANT FOR SALE.

TO BE SOLD separately, or in one lot—
Two Double-Lift HOLDERS, 34 ft. 4 in. diameter outer, 32 ft. 10 in. inner, 14 ft. 3 in. deep, with Pipes, &c.
One GOVERNOR, SYPHON-BOXES, VALVES, &c.
One STATION METER, with Valves (new), Braddock's make.
One Set of four PURIFIERS, 7 ft. square by 4 ft. deep, Walker's make, with Grids and one of their Centre-Valves, Connections, and Lifting Gear.
One TAR-PUMP and STORE BOILER.
One "ECLIPSE" WASHER-SCRUBBER, Laycock and Clapham, with Pulleys and Governor, erected in 1890.
One EXHAUSTER, with 12-inch Valves and Connections.
One Horizontal CONDENSER, with fourteen 8-inch Pipes, 18 ft. long, with Bye-Pass, Valves, and Connections.
Twenty RETORT MOUTHPIECES, with Lids and Duplicates, Dip, Ascension, and Bridge Pipes, Hydraulic Main and Valve, Fire-Doors, Buckstaves, and Tie-Rods.
12-inch and 8-inch MAINS, at per ton.
12-inch VALVES, at each.
For further Particulars and Prices, apply to H. I. WILLIAMS AND CO., Kidsgrove, STOKE-ON-TRENT.

TO TAR DISTILLERS AND OTHERS.

THE Corporation of Beverley are pre- pared to receive TENDERS for the purchase of the surplus TAR made at the Beverley Gas-Works for One Year from and after the 1st of May next.
Further Particulars may be obtained from Mr. Gibson, the Manager at the Works.
Endorsed tenders to be sent to me not later than Monday, the 26th inst.

By order,
J. WILLIS MILLS,
Town Clerk.

Guildhall, Beverley,
April 2, 1897.

TENDERS FOR RETORTS.

THE Brentwood Gas and Coke Company invite TENDERS for the supply of 20 OVAL RETORTS (Stourbridge), 21 in. by 15 in., and 9 ft. 3 in. long, to be delivered in Trucks at Brentwood Railway Station (G.E.R.), in one month from receipt of order.

The Directors do not bind themselves to accept any tender.

C. A. FIELDER,
Secretary.

Brentwood, Essex,
April 10, 1897.

TENDERS FOR GAS COAL.

THE Brentwood Gas and Coke Company invite TENDERS for the supply of about 4300 Tons of screened GAS COAL in Trucks at the Brentwood Railway Station (G.E.R.), at per ton, to be delivered in the following quantities the second week of each month: June, 140 Tons; July, 160 Tons; August, 300 Tons; September, 500 Tons; October, 550 Tons; November, 500 Tons; December, 560 Tons; January, 500 Tons; February, 350 Tons; March, 300 Tons; April, 250 Tons; May, 190 Tons.

Tenders, with Analysis of the Coal to be supplied, and Terms for Monthly Payments, to be sent to the undersigned on or before the 30th inst.

The Directors do not bind themselves to accept the lowest or any tender.

C. A. FIELDER,
Secretary.

Brentwood, Essex,
April 10, 1897.

ULVERSTON URBAN DISTRICT COUNCIL.

TENDERS FOR COAL AND CANNEL.

THE Gas and Water Committee invite TENDERS for the supply of best screened GAS COAL and CANNEL for One, Two, or Three Years, commencing the 1st of July next.

Parties tendering must give full Particulars of the Coal and Cannel they propose to supply; and name the Pit from which the same will be raised.

Further Information and Forms of Tender may be obtained on application to the undersigned.

Sealed tenders to be sent in not later than the 29th inst., addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Coal or Cannel."

The Committee do not bind themselves to accept the lowest or any tender.

JNO. SWAN,
Engineer and Manager.

ULVERSTON URBAN DISTRICT COUNCIL.

TO TAR DISTILLERS.

THE Gas and Water Committee invite TENDERS for the purchase of the surplus TAR produced at their Works during the Year commencing the 1st of July next.

Further Particulars and Forms of Tender may be had on application to the undersigned.

Sealed tenders to be sent in not later than the 29th inst., addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Tar."

The Committee do not bind themselves to accept the highest or any tender.

JNO. SWAN,
Engineer and Manager.

TODMORDEN CORPORATION.

THE Gas Committee are prepared to receive TENDERS for the supplying and fixing at their Gas-Works, Todmorden, of One ROTARY SCRUBBER-WASHER, capable of passing 800,000 Cubic Feet per day.

Full Particulars and Forms of Tender may be obtained on application to Mr. H. Hawkins, Gas Engineer, Todmorden.

Sealed tenders, endorsed "Tender for Rotary Scrubber," to be delivered to the undersigned not later than Five p.m. on the 19th inst.

The lowest or any tender not necessarily accepted.

By order,
D. SUTCLIFFE,
Town Clerk.

April 8, 1897.

TODMORDEN CORPORATION.

THE Gas Committee are prepared to receive TENDERS for the supplying and fixing of two ROTARY EXHAUSTERS, with ENGINES combined.

Full Particulars and Forms of Tender may be obtained on application to Mr. H. Hawkins, Gas Engineer, Todmorden.

Sealed tenders, endorsed "Tender for Exhausters," to be delivered to the undersigned not later than Five p.m., on the 19th inst.

The lowest or any tenders not necessarily accepted.

By order,
D. SUTCLIFFE,
Town Clerk.

April 8, 1897.

YEOVIL CORPORATION WATER-WORKS.

THE Mayor, Aldermen, and Burgesses of the Borough of Yeovil are prepared to receive TENDERS for the construction of a COVERED SERVICE RESERVOIR at Yeovil.

Drawings and Specifications may be inspected and Forms of Tender and Schedules of Quantities may be obtained (on payment of Two Guineas, returnable if a *bonâ-fide* tender be made) on application at the Office of the Borough Surveyor, in George Court, Yeovil, and at the Office of Messrs. T. & C. Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W., on and after Tuesday, the 13th day of April; and Tenders must be delivered at the Office of the Town Clerk at or before Ten o'clock in the forenoon of Friday, the 30th day of April next.

The Corporation do not pledge themselves to accept the lowest or other tender.

H. B. BATTEN,
Town Clerk.

Yeovil, April 5, 1897.

PUBLICATIONS
ISSUED BY
WALTER KING,
11, BOLT COURT, FLEET STREET, LONDON, E.C.

ALL PARCELS SENT CARRIAGE FREE.

THE
SIXTIETH ANNIVERSARY OF THE QUEEN'S REIGN.

Price (free by Post) 5s. 6d., Cloth,

EIGHTY-TWO DEVICES FOR

GAS ILLUMINATIONS

With Instructions for Coloured Fires, &c.

By THOMAS NEWBIGGING, C.E.

This Collection of Devices was originally issued in connection with the Queen's Jubilee; but it will be found equally serviceable during the coming Celebration of the Sixtieth Anniversary.

THE FLOW OF GASES & PROPORTIONING GAS-MAINS. — FOUR DIAGRAMS (with explanatory pamphlet). Invented by F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E. Price 7/6, Demy 4to., Limp Cloth.

THE GUIDE-FRAMING OF GASHOLDERS AND OTHER PAPERS, CHIEFLY RELATING TO STRAINS IN STRUCTURES CONNECTED WITH GAS-WORKS. — By F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E. Bevelled cloth. Price 6/-.

THE CHEMISTRY OF ILLUMINATING GAS. —By NORTON H. HUMPHRYS, Assoc.M.Inst.C.E., F.C.S. Price, bound in cloth, 6/-.

TRANSACTIONS OF ASSOCIATIONS OF GAS ENGINEERS AND MANAGERS OF THE UNITED KINGDOM FOR 1896.—Price, bound in cloth, 5/6. The Thirteen previous Volumes (1883-95) are still on sale, Price 3s. each.

ANALYSIS OF THE ACCOUNTS OF THE METROPOLITAN WATER COMPANIES.—Issued Annually, as compiled and arranged by ALFRED LASS, F.C.A. Sixteenth year, 1895-96, price 15/-. Previous Volumes still on sale.

TABLES OF VALUES, DISCOUNTS, DIVIDENDS, AND WEIGHTS AND MEASURES, FOR USE IN GAS OFFICES.—Arranged by THOMAS NEWBIGGING, M.Inst.C.E. Price 2/-.

CONSPIRACY AND PROTECTION OF PROPERTY ACT.—It is required, under a Penalty of FIVE POUNDS, that a printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat. Printed copies of this section, in large type, on broad sheets, price 2/- per dozen, or 10/6 per 100. The Act extends to Scotland and Ireland.

ORDERS FOR OTHER TECHNICAL PUBLICATIONS WILL BE EXECUTED AT PUBLISHERS' PRICES.

COUNTY BOROUGH OF WIGAN.

THE Gas and Electric Lighting Committee invite TENDERS as follows:—

Contract No. 1—CAST MAINS and CONNECTIONS.
" 2—WROUGHT-IRON TUBE and FITTINGS.
" 3—BRASS TUBE and FITTINGS.
" 4—LEAD PIPE.
" 5—FIRING & CHARGING SHOVELS.
" 6—BROOMS.
" 7—WOOD TROUGHING & COVERING
" 8—GALVANIZED STOVE PIPE and CONNECTIONS.
" 9—BAR IRON.
" 10—STREET-LAMPS.

The contracts will be for One Year, commencing on the 1st of April, 1897, and ending on the 31st of March, 1898.

Forms of Tender to be obtained from the undersigned.

The Committee do not bind themselves to accept the lowest or any tender.

Tenders, sealed and endorsed with the name of the article tendered for (a sample of which must be forwarded, addressed to the Gas Engineer), to be addressed and delivered to J. J. Charnock, Esq., Town Clerk, Town Hall, on or before Tuesday, the 20th of April next.

JOSEPH TIMMINS,
Engineer.

Borough Gas-Works, Wigan,
March 30, 1897.

COUNTY BOROUGH OF BURY.

TO SULPHURIC ACID MAKERS.

THE Gas Committee of the Bury Corporation are prepared to receive TENDERS for the supply of about 350 Tons of SULPHURIC ACID for the Manufacture of Sulphate of Ammonia, for a period of One Year from the 1st of May, 1897.

Form of Tender and Conditions may be obtained on application to Mr. W. H. S. Gendall, Engineer and Manager, Gas-Works, Bury.

Sealed tenders, endorsed "Tender for Acid," to be sent to me the undersigned on or before Monday, the 19th of April, 1897.

Preference will be given to those persons or firms who pay to their workpeople the regular standard rate of wages obtaining at the time in the town or district.

JOHN HASLAM,
Town Clerk.

Corporation Offices, Bury,
April 1, 1897.

SHEFFIELD UNITED GASLIGHT COMPANY.

WATER-TANK.
TO ENGINEERS, IRONFOUNDERS, &c.

THE Directors of this Company invite TENDERS for the supply and erection of a CAST-IRON WATER-TANK, 41 ft. 6 in. by 29 ft. 6 in. by 8 ft. 6 in. deep, together with Ladders, Landings, Girders, &c., at their Neepsend Station.

Drawings may be seen, and Specification with Bill of Quantities obtained, on application to the Engineer, Mr. Fletcher W. Stevenson, on payment of 10s. 6d., which will be returned on receipt of a *bonâ-fide* tender.

Sealed tenders, endorsed "Tender for Water-Tank," must be delivered (by post) at the Company's Offices, not later than the first post on Saturday, the 1st day of May next.

The Directors do not bind themselves to accept the lowest or any tender.

HANBURY THOMAS,
General Manager and Secretary.

Commercial Street, Sheffield,
April 7, 1897.

RAMSGATE CORPORATION.
(GAS AND WATER DEPARTMENT.)

THE Gas and Water Committee invite TENDERS for the supply of first class NEWCASTLE GAS COAL, in three annual quantities of 19,000, 20,000, and 21,000 Tons, delivered free into Carts on the Quay of Ramsgate Harbour.

The first quantity of 19,000 Tons to be delivered in equal monthly quantities between the 1st of July, 1897, and the 30th of June, 1898; the second and third Years' supplies also in equal monthly quantities between the 1st of July, 1898, and the 30th of June, 1899, and the 1st of July, 1899, and the 30th of June, 1900. A distinct price to be named for each annual quantity.

Tenders to be sent in not later than Saturday, May 1, addressed to the Chairman of the Gas and Water Committee, Hardres Street, Ramsgate, endorsed "Coals."

The Committee do not bind themselves to accept the lowest or any tender.

Full Particulars and Form of Tender on application to

WILLIAM A. VALON,
Engineer.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Powers.

He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.

Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.

Offices: 18, FINSBURY CIRCUS, E.C.

By Order of the Directors.

200 SHARES IN THE

WORTHING GASLIGHT AND COKE COMPANY.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Monday, May 3, at Two o'clock, in Lots, 200 £10 fully-paid SHARES in the above Undertaking, ranking for a Standard Dividend of 7 per cent. per annum; the last Dividend on similar Shares in the Company having been at this rate.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.

500 SHARES IN THE

SOUTHEND WATER-WORKS COMPANY.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Monday, May 3, at Two o'clock precisely, 500 £10 SHARES to be issued as fully-paid in the above Undertaking, ranking for a Maximum Dividend of 7 per cent.; the last Dividend on the same class of Shares having been at the rate of 5 per cent. per annum.

PARTICULARS of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C., and TOTTENHAM.

By order of the Executors of the late William Charles Barnes, Esq., and other Executors and Owners.

GAS AND WATER STOCKS AND SHARES AS FOLLOWS:—

Chigwell, Woodford, and Loughton Gas Company—£1200 Stock, 379 £10 Shares, and £50 Debenture.
Harrow and Stanmore Gas Company—58 £10 Shares.
Portsea Island Gaslight Company—12 £50 Shares.
Cromer Gas and Coke Company, Limited—40 "A" Shares.
Godstone District Gas Company—60 Shares.
Horley District Gas Company—80 Shares.
Epping Gas Company, Limited—Two Shares.
Clacton-on-Sea Gas and Water Company—80 Shares.

MR. ALFRED RICHARDS will Sell the above BY AUCTION, at the Mart, E.C., on Monday, May 3, at Two o'clock, in lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

IMPERIAL CONTINENTAL GAS ASSOCIATION.
(INCORPORATED BY ACT OF PARLIAMENT.)

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Association will be held at the City Terminus Hotel, Cannon Street, London, E.C., on Tuesday, the 4th day of May next, at 2.30 p.m. precisely, when a Report will be made to the Proprietors, a Dividend declared for the Half Year ended the 31st of December last, and the usual Ordinary Business of such Meeting transacted.

NOTICE IS HEREBY ALSO GIVEN, that the CAPITAL STOCK TRANSFER BOOKS WILL BE CLOSED from the 20th inst. to the 4th of May, both days inclusive.

The Dividend will be paid on the 11th of May.

By order of the Board,
ROBERT W. WILSON,
Secretary.

21, Austin Friars, London, E.C.,
April 12, 1897.

PATENTS, DESIGNS, AND TRADE MARKS ACTS, 1883 TO 1888.

NOTICE is Hereby Given, that Gustave TROUVÉ, of 14, Rue Vivienne, Paris, France, has applied for LEAVE TO AMEND THE SPECIFICATION of Letters Patent No. 23,521, of 1895, for "Improved Apparatus for Producing, Storing, and Utilizing Acetylene Gas."

Particulars of the proposed Amendments were set forth in the "Illustrated Official Journal (Patents)," issued on the 7th April, 1897.

Any person or persons may give notice of Opposition to the amendment (on Form "G"), at the Patent Office, 25, Southampton Buildings, London, W.C., within One calendar month from the date of the said "Journal."

(Signed) C. N. DALTON,
Comptroller General.

A. M. & WM. CLARK,
Chartered Patent Agents,
53, Chancery Lane, London.

E. ASQUITH & CO.,
Hydraulic Engineers,
17, Mather Street, Ancoats, Manchester,
Fit up Plants for
Pressing Anthracene, Naphthalene, &c.
Competent Men sent out to erect same. Estimates given.

THE "COOMBE" DRAUGHT SCREEN
FOR INCANDESCENT BURNERS.
For Illustration and Statement of Advantages to be gained by its use, see "JOURNAL," April 6, p. 602.
ALFRED ARCULUS & CO., Glass Manufacturers,
BIRMINGHAM.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.
FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

HOLMSIDE GAS COALS.
PRESENT DAILY PRODUCE OVER 4000 TONS.
LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.
PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.
RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash . . . . . 1·34 Per Cent.
Tar . . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COAL-FIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

GOOD & SPENCER'S PATENTED METHOD OF SCURFING RETORTS.

April 10, 1897.

THE REVISED CHARGE FOR ROYALTY is 10s. per Annum for a make up to 15 million cubic feet; and above that, 8d. per million cubic feet.

For Particulars and License, apply to
J. E. & S. SPENCER,
14, GREAT ST. THOMAS APOSTLE, LONDON, E.C.

NOTICE IS HEREBY GIVEN, that after this date any Gas Company, Corporation, or Firm using their Method for Cleaning Retorts without holding a License will be prosecuted.

£5 REWARD will be paid to any Person who gives such Information to the Patentees that secures a conviction.

INCANDESCENT STREET LIGHTING.

THE ONLY SUCCESSFUL ECONOMICAL AND EFFICIENT
ANTI-VIBRATION SYSTEM.
Every Gas Engineer, Gas Manager, and Lighting Authority should adopt it.
Applicable to existing Lamps.
THE LARGEST INSTALLATION OF INCANDESCENT STREET LIGHTING IN ANY BRITISH TOWN IS ON THIS SYSTEM.
SUCCESSFUL RESULTS GUARANTEED IN ALL SITUATIONS.

Full Particulars on Application to
THE ANTI-VIBRATION INCANDESCENT LIGHTING COMPANY,
Limited,
12 & 14, WESTGATE ARCADE, BRADFORD, YORKS.
WE HOLD THE ORIGINAL PATENTS.

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.

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Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

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Have **no Connection** with the above Company. They have **no Travellers** in the Provinces, and **do not sell Mantles.**
Cheapest House for all Incandescent Fittings. Send for Price List.
THE BEST BURNER IN THE KINGDOM,
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SPECIALLY DESIGNED
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BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Danish Gas Company, Bombay Gas Company, San Paulo Gas Company, Alliance and Dublin Consumers' Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

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WORKED BY THE
WEARDALE IRON & COAL Co., Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by
Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton .	10,500	Cub. Ft.
Illuminating Power .	16·9	Candles.
Coke (of good quality) .	67·5	per Cent.
Sulphur	0·58	,,
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GAS ILLUMINATION JUBILEE DEVICES.

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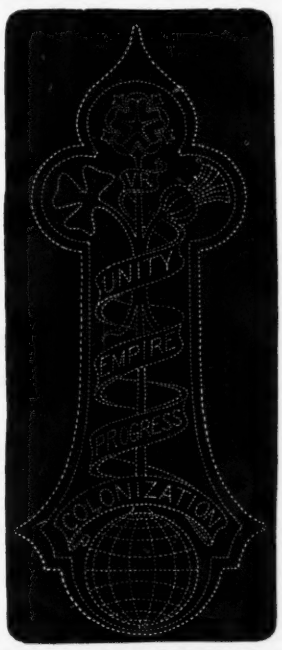

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Coke per ton . . . . . 1,301·88 lbs.

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Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 17·8 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

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FOR GAS-FURNACES.
Trade Mark: "SILICA."
These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY,
Strongly recommended where EXCESSIVE HEATS have to be maintained.

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COLSON'S PATENT)

EXTRACT FROM ENGINEER'S REPORT: "I can now obtain **60** Tons of Sulphate of Ammonia per week with 'Colson's' Still, using ONE Boiler, whereas, with my former continuous plant, TWO Boilers were required to produce **40** Tons per week."

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Patent Automatic Machinery
FOR
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Full Particulars may be obtained from the Sole Makers,
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[See Illustrated Advertisement, April 6, p. 761.]

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WITH PATENT SHADE.

The ONLY GAS-PENDANT suitable for Domestic Lighting; a room 18 ft. by 14 ft. being beautifully illuminated with one Incandescent Burner.

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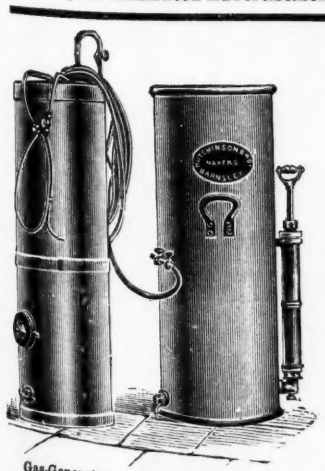
it quite **supersedes** the familar three-light pendent. We are able to bear witness to the **convenience** of the New Pendant."



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SATURATORS, all Lead, or Strong Sheet Lead, in Wood Casing,
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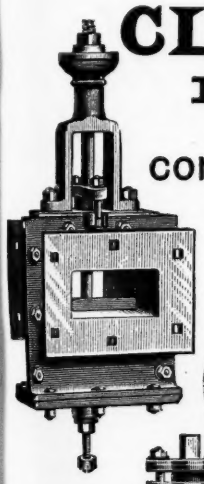

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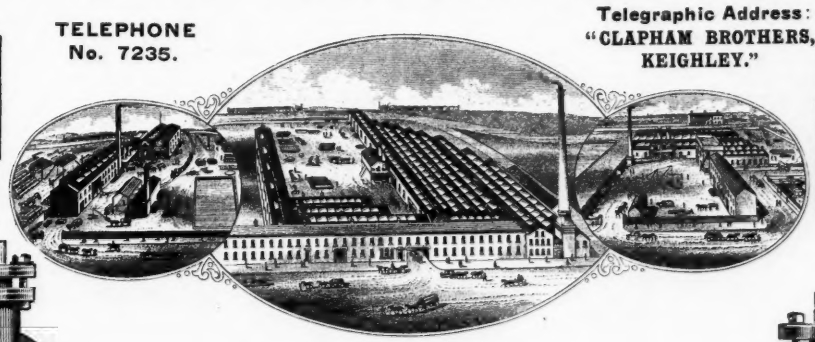

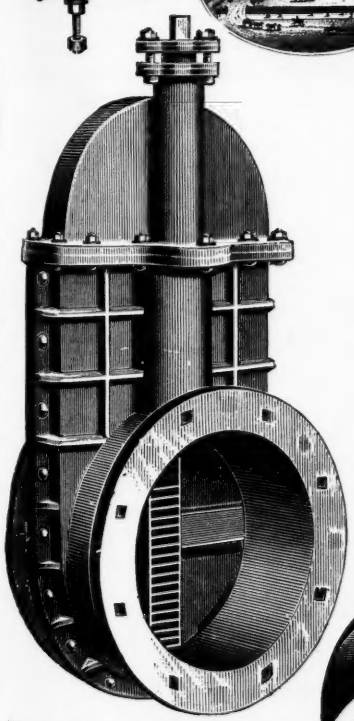

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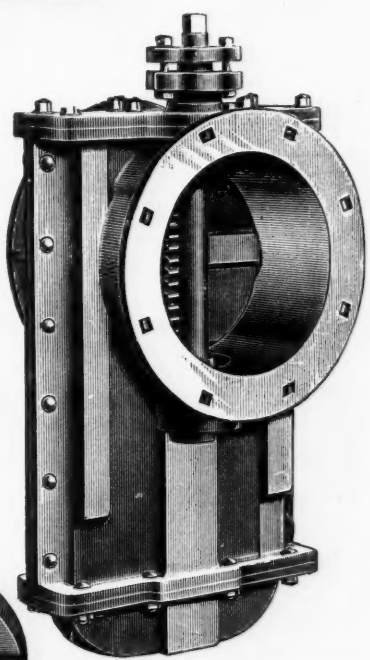

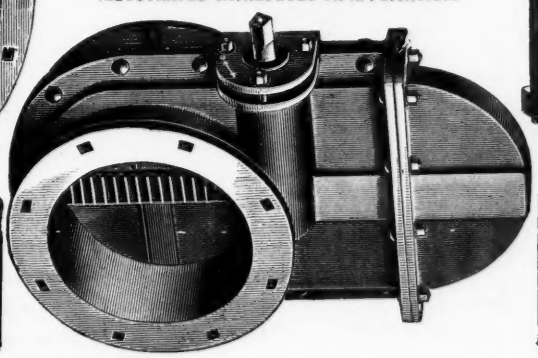

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[See Illustrated Advertisement, April 6, p. 799.]

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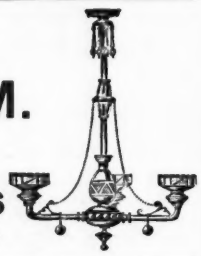

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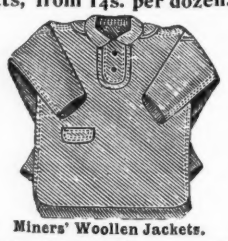
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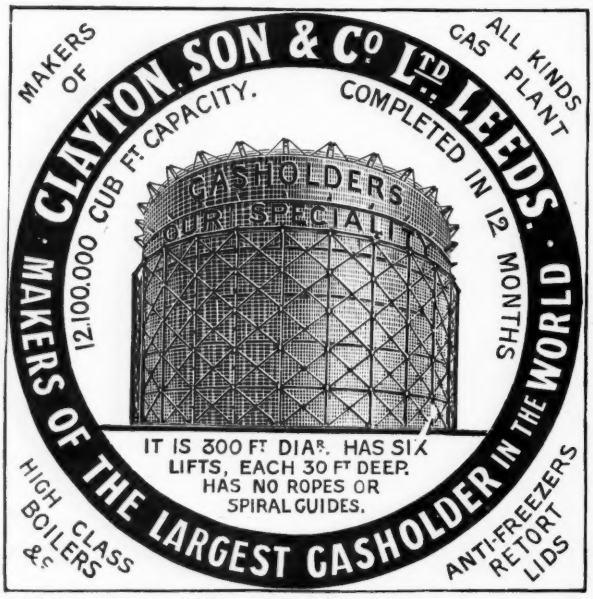
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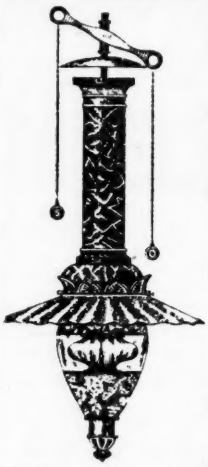

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CLASS A— 55/-
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Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

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These **Patent Twisted Taper Rymers and Taps** are the best ever made for Gas and Water Service Connections. A true Hole and a correct Thread can be assured. They are easy to work, and will last much longer than straight grooved Taps and Rymers.

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SOCKET-PIPES FOR GAS OR WATER PURPOSES.

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Sole Manufacturers of **LYON'S "PATENT" GAS-MAIN SYPHONS.**

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Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

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Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

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60 GASHOLDERS ERECTED AND AT WORK.

IN CONSTANT USE FOR 7 YEARS.

DEMPSTER'S IMPROVED COLUMNLESS GASHOLDERS.

ALL CARRIAGES ACCESSIBLE AND NEVER IN CONTACT WITH WATER IN TANK.

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PATENT LIGHT-DIFFUSING GLOBE

Guaranteed to give more Light, with better Diffusion, than any Globe in existence.

Dr. DREHSCHMIDT, of Berlin, has recently made exhaustive tests with the latest "Holophane" Patent Light-Diffusing Globes, when used with Incandescent Gas-Burners, and has proved conclusively **that, below the horizontal, the "Holophane" gives an average of 29 per cent. more light than the bare Incandescent Burner; and at angles below 45 degrees,**

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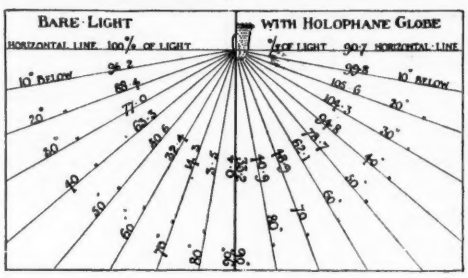

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